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ELECTRIC LIGHT IN THE SOUTH OF ENGLAND.

IDERABLE surprise has been expressed that the ic light has not made more rapid progress in the towns of the South of England. In the first port, although residents are frequently reminded e flashings of the search lights on the men-of-war bour and at Spithead, of the brilliancy and power new illuminant, scarcely anything has been yet plished towards placing the new light within of the public. It is true that while the great ed fleet was at anchor at Spithead, the Corpora- pent a few pounds upon the illumination by elec- y of the grand sea front, and enabled the inhabi- and visitors who flocked to the beach while the "leviathans" were at anchor in the historic to contrast the bright and pure electric light e yellow, flickering flame emitted from the gas . But notwithstanding this practical illustration superiority of the electric light, there are no ions of an ardent desire on the part of the public Portsmouth to respond to what is really a r demand for more and better light. One enter- firm of brewers has introduced the electric n a charmingly situate hotel, at the picturesque e to Portsmouth Harbour, and visitors with one profess themselves delighted with it. But up to ent time only two commercial establishments dopted the light, and this for the very valid that facilities are not placed in their way. The that "vested interests" exercise a potent influ- d an opinion prevails in Portsmouth that if the pany were not so strongly represented in the Council a different state of things would exist. al Town Hall, which will cost considerably 100,000, is now nearing completion. If a poll of abitants could be taken there would, it is , be an overwhelming consensus of opinion in of lighting every nook and cranny of the vast interior by electricity. The matter has been discussed both in committee and in the Council, but there is reason to believe that unless those who are unaffected by plethoric gas companies dividends are particularly wide awake, there will be only a partial and altogether inadequate electric light installation. Little information has recently been afforded the public respecting the action of the Committee on this important matter; but there are substantial reasons for the opinion that a bold and vigorous initiative on the part of the County Council, in reference to the lighting of their fine *Hôtel de ville*, would give a much-needed impetus to the introduction of the electric light into Portsmouth. The example of the municipal authorities would, in fact, be contagious, and those who are interested in piers, hotels, and other undertakings would speedily follow suit. All that is wanted is what is known as a "friendly lead," and in that case the trading community would not be slow to avail themselves of any facilities that were offered for substituting the electric light for gas, in respect to which, by the way, complaints were made at the council meeting last week. At Southampton, too, the electric light has not yet come within the domain of practical projects, although the shopkeepers, especially those residing in the noble High Street, the pride of the denizens of the "Liverpool of the South," would rejoice in a new departure. That rising watering place, Bournemouth, is now in the throes of a great agitation, anent a proposal to purchase the gas and water works, and one of the chief grounds of opposition is the possibility of enormous loss consequent upon the probable early advent of the electric light. Mr. G. J. Piercy writes :—"The new light has, until lately, been unfairly hampered by restrictive legislation, but now that this burden has been removed by a more enlightened and fair dealing Act, I contend that this is not the juncture at which the town should undertake so serious a risk, to say the least of it, of heavy eventual loss. It is said that in places where the electric light is adopted the gas consumption has been increased, but I am sure most people will agree with me that a longer time should be allowed to elapse before statements like these can be worth much as proofs in the argument. The English are slow to move, but when they know what the new light is, I think there will be few people who, if unhampered in their choice, will elect a foul, unwholesome, and dangerous thing like gas of any kind in preference to the electric light, with all its advantages, not the least being the ease with which it can be economised without the smallest drawback to its efficiency." Many, however, are strongly persuaded that gas companies will not suffer from electricity, and Mr. Massingham, the manager of the electric lighting works at Exeter, speaking from practical experience at Taunton, at a recent meeting in the "ever faithful city," said :—"At the former place the electric light was introduced four years ago, and, of course, the shareholders of the gas company were up in arms, thinking they would get very small dividends, but as a matter of fact a demand for a better light was created, with the result that since Taunton had been lit by electricity the gas company had sold more gas than they had ever done before in the same period. So the electric light had actually benefited them." Mr. Massingham added that he was quite sure that the unnecessary alarm which was felt in Exeter when the introduction of the light was first suggested had proved groundless; he sincerely believed that the local gas company would be benefited, because there was no more chance of the electric light doing away with the use of gas than the steam engine had of doing away with horses. At Hastings, one of the most flourishing watering places on the South Coast, the Council has decided to apply for a provisional order to supply the electric light, the action of the municipal body having doubtless been quickened by the complaints of the defective quality of the gas. Surprise is expressed in many town in the South of England that the gas companies have not taken action for the purpose of supplying the electric light; there is, however, one exception, viz., at Falmouth, whose gas company wishes to have two strings to its bow. An influential inhabitant interposes a strong objection. "If," he says, "the Town Council consents to their application for supplying electric light it will, in my opinion, have reason to regret it. Why do not the Corporation ask for borrowing powers, and ask the parishes of Falmouth, Penwerris, and the Borough of Penryn to amalgamate for the purpose of joining with the borough in order to supply electric light to the whole of the two towns, to be worked by water supplied by the Water Works Company? If, as an authority, we sanction the present application, what will the result be? The shareholders of the Falmouth Gas Company have been deriving big dividends and bonuses at the expense of the consumers. Compare the charges at Plymouth with those of Falmouth; every fair minded man must admit that the latter are very high, and can only be reduced by the public bodies of this and other places taking the matter up in order to relieve the ratepayers of some of the heavy burdens they have now to bear." The foregoing quotation is but a sample of the complaints, which are universal, as to the price and quality of the gas supplied, and, having regard to them, it is "passing strange" that the electric light has not made greater progress. But, notwithstanding all the opposition that the new light has to encounter, time is on the side of the improved illuminant, and when once a really good start has been made it will advance by "leaps and bounds."

VIENNA at present offers a haven of rest for some of the many ex-useful electric light patents. The *St. James's Gazette* says that a millionaire has just died in that fair city who had such an antipathy to darkness that he has left instructions in his will for the illumination of his last resting place. An electric light is to be kept burning in the vault for a whole year, and even the interior of the coffin is to be electrically lighted. The expenses are to be defrayed by a special bequest of 20,000 marks. This is one way, says the *St. James's Gazette*, of brightening the dark road to eternity; knowing some electric lights we should think not.

THE address of Prof. Flower to the British Association is very intesesting reading, but it contains nothing of any interest whatever to the engineer, electrician, chemist, mathematician or physicist. It is mainly a dissertation upon the organisation and management of museums, and it will afford much food for reflection to the minds of those who are either directly or indirectly connected with these valuable institutions. Those who expected something sensational in the way of fresh theories or doctrines were doomed to disappointment, and the address will probably be voted as one of the tamest and mildest ever delivered by a President of the British Association for the Advancement of Science. It is, however, eminently respectable, and not calculated to upset preconceived notions, or to painfully affect a sensitive nature such as has been the case on more than one previous occasion.

Mr. W. D. **SANDWELL** has written to us respecting the letter of Mr. Willis, which appeared in our last issue. He also sends two specifications of his patents, "by which you will see that they are not anticipated by the sketches in your paper of April 13th, 1888." We have examined these blue books, and find that in one there is claimed :—"The combination with a tramcar or other vehicle or apparatus adapted to be driven by electricity of an electric motor mounted on the said car and a set of accumulators from which the electricity for operating the said motor is derived, the said accumulators being located in a truck or tender adapted to be connected with and disconnected from the tram-car, or the like, as set forth." In the other we find that the inventor does not claim placing two armatures on the same axle, one only of such armatures being operative at the same time; but he claims :—"In an electric motor the employment of two armatures in connection with one set of field magnets, the said armatures and field magnets being arranged in such a manner that they can be moved relatively to each other for enabling either armature to work in the magnetic field for the purposes specified." In how much this last claim trenches upon the patent of Mr. Jarman, or in what the value of the first consists, we leave others to decide. Mr. Sandwell very kindly volunteers to supply us with an epitome of his failures and the causes at Holloway, but we really do not think that it is necessary. We have previously expressed an opinion upon his apparatus, and so far we see no good reason for modifying our remarks.

THE inauguration of the Bradford electric light installation is to take place about the middle of next month. Even at the present moment the arrangements for the supply of electricity are practically complete, and it would be possible to lay on the current at once if it were considered urgently necessary, but as several members of the Lighting Committee are absent, and the evenings will soon begin to lengthen, a postponement has been deemed advisable, a course which will allow time for engaging a staff of *employés*.

THE Sunderland Gas Company probably supplies gas at a cheaper rate than any other company in the kingdom—namely, at 1s. 6d. per thousand to large consumers. This very moderate price is doubtless the reason why the chairman of the company (Mr. E. C. Robson), at the annual meeting last week, made such remarkable statements, which showed great ignorance. No large town, he said, was lighted by electricity at a profit; but there are, as many persons are aware, several towns in the United Kingdom where public electric lighting has been made a financial success. Then, again, he had never heard of electricity being supplied at a cheaper price than that which corresponds to 1,000 feet of gas at 6s. 8d. This price is, of course, equal to the Board of Trade unit at 8d., which is the maximum rate permitted to be charged by that Department. We wonder whether the chairman was furnished with a copy of a price list issued a short time ago by a certain provincial electric lighting company offering to supply current at 4½d. per unit, which is equivalent to gas at 3s. 9d. per thousand. Other companies are also about to supply current, or are already doing so, at less than the 8d. maximum.

THE Nottingham papers state that an important invention has been made by a fellow townsman of the "lambs." The primary object of the patent is to afford means whereby the driver of a locomotive may tell exactly how the signals are at particular points on the railway over which his train is proceeding. A further important use of the apparatus is in the direction of registering distances between trains and establishing telephonic communication. For the experiments on Saturday last, as in the preceding week, a mile and a quarter of the suburban line, running from Sherwood Station towards Daybrook, had been selected. Parallel with the permanent way, a slight wooden rail had been placed, upon the zinc-covered surface of which a wire was laid. By means of a brush attached to the footplate of the engine electric communication was established in turns between the wire and two dials placed on the weatherboard of the locomotive. One of the dials was in the form of a miniature semaphore signal, the other being similar in appearance to a steam gauge dial, and capable of registering distances from a quarter of a mile up to nine miles. In all respects the apparatus worked admirably. An operator was stationed at each end of the wire, and when acting upon a previously arranged code the signals were put on or taken off, the fact was at once indicated by the dropping or raising of the arm of the small semaphore signal on the engine. This was effected with the greatest readiness, whether the locomotive was stationary or in motion. By means of the second dial the distance between various points was also indicated to a nicety. The telephonic possibilities of the invention were not tested on Saturday, but the experiments in the previous week amply demonstrated the possibility with Mr. Andrews's apparatus of a driver, guard, or passenger in one train communicating with a person in another train. Acting on a similar plan, it, whilst in motion, is also regarded as being possible for a passenger to communicate from a train to a telegraphic office *en route*, and give instructions for sending a message. The use of the signalling apparatus would probably prove of the greatest value in foggy weather, when the ordinary signals cannot be seen. At any point from 200 to 400 yards outside the distance signal, the driver would be able to tell at once in what position the particular signal might be, and whether he was at liberty to proceed. We hope shortly to hear further particulars of this invention, although if the inventor can ever succeed in inducing railway companies to adopt it, we shall consider that his neatest feat, for no matter how good and useful a purpose an invention may effect, it is more or less the labour of a lifetime to get it adopted on English railways.

IN an evening contemporary (the *St. James's Gazette* of last Friday) the following paragraph appears under the heading of "The Greatest Depths of the Ocean":—"The greatest known depth of the sea is in the South Atlantic Ocean, midway between the Island of Tristan d'Acunha and the mouth of the Rio de la Plata. The bottom was there reached at a depth of 40,236 feet, or 8¾ miles, exceeding by more than 17,000 feet the height of Mount Everest, the loftiest mountain in the world. In the North Atlantic Ocean, south of Newfoundland, soundings have been made to a depth of 4,580 fathoms, or 27,480 feet, while depths equalling 34,000 feet, or 6½ miles, are reported south of the Bermuda Islands. The average depths of the Pacific Ocean, between Japan and California, is a little over 2,000 fathoms; between Chili and the Sandwich Islands, 2,500 fathoms; and between Chili and New Zealand, 1,500 fathoms. The average depths of all the oceans is from 2,000 to 2,500 fathoms." This information is incorrect in every particular, and might give rise to misgivings in the minds of those interested in submarine cables, as such loose and careless statements frequently do, when backed up with an appearance of authority. The greatest depth between the Island of Tristan d'Acunha and the mouth of the Rio de la Plata is not 6,706 fathoms, but 2,900 fathoms. In the North Atlantic, south of Newfoundland, the greatest depth is 3,327 fathoms, not 4,580 fathoms. To the south of Bermuda, the greatest depth is 3,825 fathoms, not 5,666 fathoms. The remainder of the information given in the paragraph is also incorrect. We believe that the deepest soundings yet taken in any waters are the following: 4,655 fathoms (or 5½ statute miles), found off the Kurile Islands by Captain Belknap, of the U.S.S. *Tuscorora*, who also found 4,643 fathoms off the Coast of Japan. Next in depth there comes a sounding of 4,561 fathoms, taken about 60 miles north of Porto Rico, in the West Indies, by Captain Bartlett, U.S.N. Following these, a depth of 4,475 fathoms was found by the *Challenger* in the Pacific to the east of the Philippine Islands; and recently, in the South Pacific, about 250 miles to the south of the Friendly Islands, a depth of 4,430 fathoms was met with by Captain Aldrich, of H.M.S. *Egeria*.

NOTES FROM SWEDEN.

THERE is every probability of a central electrical station being soon established in Stockholm by the city, the gas board claiming to be able to solve this question more satisfactorily to the public than a number of small speculators, whilst the economical result may be gauged by the large profit yielded by the gas works. However, as the plans hitherto submitted for such a central station have been wholly incomplete and useless, the gas board proposes that an *international* competition for the works be invited, with prizes for the best plans and suggestions, and that to this end a sum of 15,000 kr. be provisionally granted the board for the purpose of preparing by an undoubtedly qualified expert the programme for such a competition. The proposal of the board will no doubt soon come before the municipal council.

The gas board has furnished some interesting particulars respecting the use of gas motors in Stockholm. Thus, at the end of 1884, when the gas for such engines was lowered to 15 öre (2d.) per cubic metre, there were 21 equal to 52 horse-power in use, whilst at the end of last year, the number had increased to 57, totalling 140 horse-power. The consumption of gas by these cost £800. However, the use of gas motors has not nearly increased so greatly as in Germany, the proportion per 1,000 inhabitants in the Swedish capital being 0·6 horse-power, whilst in Germany it ranges from 0·9 to 2·4 H.P. per 1,000. It is therefore demanded that the price be lowered.

The report of the Electrical Lighting Company, of Stockholm, for last year, shows great progress, 36 dynamos and 4,139 lamps having been delivered, as against 20 and 2,658 respectively in 1887. Since the formation of the company, in 1883, 121 dynamos have been delivered, of 1,426 horse-power, which are now working 13,100 glow and 15 arc lamps. The profit last year on the capital was 7 per cent., but the whole of it is to be employed in enlarging the business.

The introduction of central municipal stations has been decided upon by the corporation of three more cities, viz., Marstrand, Arboga, and Ostersund, with about 1,000 lights in each.

The Swedish Patent Office has issued some interesting statistics, from which it appears that during the last three years 18 patents were taken out by Swedes upon illuminating inventions, 3 only, however, referring to the electric lighting, the rest to the perfection of gas. This is explained by the circumstance that the attention of Swedish electrical engineers just now is wholly concentrated upon supplying the demand for electricity for every purpose. As regards motors, for the same reason, 26 patents were granted for gas, steam, and water motors, but not a single one for electrical ones. However, 7 patents granted referred to the telegraph and telephone service.

A new telephone tax has come into force in Sweden, whereby the charge on the State telephones has been fixed at 30 öre (4d.) for three minutes' conversation when the distance is under 100 miles, and 50 öre (6½d.) for distances above, with 10 öre (1¼d.) for every extra minute in both cases. However, if the telephone be bespoken, each conversation must not last more than five minutes. The reason of this curtailment of time is that very few conversations occupy the time now allowed, viz., five minutes. This has also been the experience in various other Continental countries, as for instance Switzerland, where the time is now also only three minutes.

A novel but useful application has been made of the telephone in Stockholm, most of the passenger coasting steamers having been fitted with apparatus which can be connected with a station on the quays when in port, whereby communication with the whole city and even most of the country is maintained—a great advantage obviously both to the public and the owners of the vessels.

The report of the Stockholm Bell Telephone Company for 1888 shows 1,755 subscribers, against 1,700 in 1887. 66 persons were employed against 73 in The earnings were £8,000, and the net profit or a little more than in 1887. The report of the holm General Company shows 4,556 subscribers, 400 in other towns. The company possesses 6,19 metres of telephone lines in the capital and 2,400 in country. In 1888, 8,768,000 messages were transmi or 29,260 a day. The earnings were £3,500, and a dend of 8 per cent. is paid.

A local telephone company has been constitut the province of Osterdalen, in Dalcarlia.

From the foreign report of the Swedish teleg service last year we learn that 750,885 messages received and transmitted, 264,318 being sent out 305,544 received, whilst 181,023 were in transit England and France, to Russia and Siberia. The in upon 1887 was 15·4 per cent. As usual, the greatest change was with this country, viz., one-fourth messages or 152,161, against 126,530 in 1887. Ger comes next with 131,525. The increase with this co in 1888 is 20 per cent., whilst 19 per cent. more me were received from than dispatched to this country.

ON CHENOWETH'S ELECTRIC CONDU

[*Report of the Committee on Science and the Arts.*]

Hall of the Franklin Institute,
Philadelphia, *April 29th*, 18

The Sub-Committee of the Committee on Scie and the Arts, constituted by the Franklin Instit the State of Pennsylvania, to whom was referred examination,

THE CHENOWETH ELECTRIC CONDUITS,

Report that: The invention belongs to that cla conduits in which the material of the conduit is pa while in a plastic condition, around one or cylindrical cores, which are removed after the pl material has hardened. The essential part of the vention is the nature of this removable core, wh enables it to be withdrawn in long lengths. This consists of a ribbon of galvanised iron, 1 inch w and of a thickness equal to No. 27 gauge, which wound spirally, forming a tube. This spiral tube rendered rigid, either by being wound around a sp wooden core, or by having paper glued around th outside. The plastic material is packed around the tubes, and after it has set the tube is removed by pull out this spiral band. When paper has been used hold the spiral together it readily tears, allowing band to be removed. When wooden cores have b used, they are first withdrawn, after which the spi band is readily pulled out.

Among the details of the system are the following:—

When paper is used to unite the spiral into a rig tube, the ribbon is first wound spirally on a mandr then covered with paper, which is glued fast to the outside of this spiral, and the whole covered with a water-proof varnish. The mandrel is then removed leaving a thin tube, which appears to be quite rig and capable of withstanding the pressure due to th packing of the plastic cement of the conduit around it These are laid in lengths and held in position whi the cement for the conduit is packed around them The ends of the one spiral ribbon are fastened to th beginning of the next by a swivel joint. After a fe days, when the cement has hardened, the spiral rib is pulled out at one of the manholes, tearing and th removing the paper around it. It is claimed that lo lengths of this spiral tube can be thus removed.

When this spiral tube is wound over a wooden c this core is made in two semi-cylindrical halv separated by a thin iron strip. The outside is pain with a mixture of clay, powdered soapstone and wa These are laid in lengths of 14 to 20 feet, and after cement is packed around them the wooden cores withdrawn, after pulling out the strip of iron ting them. This leaves the spiral tube, which remains until the cement has hardened, and is then withdrawn in long lengths.

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* *Franklin Institute Journal.*

The inventor claims that continuous lengths of 400 feet of spiral tube can thus be withdrawn. For removing this ribbon the inventor states that he has a peculiarly constructed reel, by means of which the ribbon can be pulled out, wound up, and untwisted in one operation.

For the material used for the conduits the inventor prefers a mixture of one part of hydraulic cement and two parts of sand. The costs are given by the inventor as follows :—

"The cost of constructing ducts by this method is narrowed down to the winding of the ribbon on the mandrel, the labour of removing the mandrels in the trench, of removing the ribbon from the duct and rewinding the ribbon on the bobbins. And as each part of the core is preserved and used an indefinite number of times, the cost of the core is charged to the cost of the plant. The winding of the ribbon is done on the spot as fast as wanted. The cost of drawing out the ribbon and rewinding on bobbins, using an ingenious device that removes all twists, is about one mill per foot. A duct, 4 inches in diameter, made of concrete, in the proportion of one of cement to two of sand, can be made for 6 cents per foot, including entire cost, exclusive of excavation, manholes, and openings."

The inventor claims that the advantages of the paper-covered tube is convenience, the cost being about the same.

The inventor gives the following comparative costs of materials for three forms of conduits. The estimate is for a conduit of four ducts, 4 inches in diameter, 1 foot long. For creosoted wood, 6 cents per foot per duct; for iron pipe, encased in concrete, 18 cents per foot per duct; for his conduit, 3 cents per foot per duct. This does not include excavation, which is about the same for all. It does not include the cost of handling his removable core.

Your committee have examined samples of these removable cores and portions of conduits made in this way, and are of the opinion that the invention is simple, ingenious, effective, and inexpensive. Furthermore, an invention of an efficient removable core enables monolithic conduits to be made of hydraulic cement, whose properties are already well known. Unlike creosoted wood, it contains no substances which are likely to attack chemically the insulation or the lead armour of cables, and, unlike iron, it does not corrode. The results, therefore, which can be accomplished by means of this removable core are unquestionably of value.

Your committee recommend the award of the John Scott Legacy Premium and Medal to Alexander Crawford Chenoweth for his improved method of laying continuous electrical conduits.

(Signed) CARL HERING,
Chairman Sub-Committee.
RICHARD W. GILPIN,
CHARLES H. RICHARDSON,
G. BETTON MASSEY.

Adopted *June 5th*, 1889.

(Signed) S. LLOYD WIEGAND,
Chairman of the Committee on Science and the Arts.

THE ELECTRIC LIGHT AT BOURNEMOUTH.

AT the meeting of the Bournemouth Commissioners on Tuesday week the Lighting Committee recommended the erection of between 20 and 30 additional lamps in the town. A member complained of the low lighting power of the gas, and Mr. Hemington, the gas inspector, mentioned that he had had his attention called to the matter, and he had on several occasions found that the power of the gas was only a little over 14 candles, which was the very lowest minimum which could be supplied. The usual power was 16 candles. Mr. H. N. Jenkins directed attention to the electric light in the square by the Brush Electrical Engineering Company, and said he thought that the permission given to erect standards should now be withdrawn. The permission was given for four or five days, and to erect four standards; there were now five standards, and if the company were allowed to remain it might be the thin edge of the wedge to make themselves the only company in Bournemouth. He therefore moved that the permission be withdrawn, which Mr. George seconded. Mr. Hankinson, in opposing, did not see why the Commissioners should be afraid of the company calling themselves the only company in Bournemouth. As a matter of fact, they were at present the only company in existence in the town, and he certainly did not see why they should be treated as curtly as proposed by Mr. Jenkins. The light in the square was a great improvement and attraction, and as the company were exhibiting it at their own expense he (Mr. Hankinson) did not see why the Commissioners should prevent them from continuing it. Mr. Sworn remarked that everybody seemed much pleased with the light. At the request of Mr. H. F. N. Jenkins the minute authorising the erection of standards was read, from which it appeared that permission was given to the company to erect standards for the light on regatta day "and for the following week or ten days." Mr. H. W. Jenkins did not think the Commissioners should be in such a hurry over the matter; it would be quite time enough to take action at the next meeting if any nuisance was caused. It was very possible the promoters themselves would discontinue the lighting before then. Mr. H. N. Jenkins withdrew his resolution, and the matter dropped.

ELECTRIC LIGHTING AT BRIGHTON.

MR. G. R. ANDREWS, the Brighton Borough Engineer, has made a report to the County Council of that borough upon the electric light installation at the Royal Pavilion, dome, free library, museum, and other buildings in connection therewith, and upon the necessity of making certain alterations before the season commences, with the view of reducing the cost of lighting and guarding against accident. The present installation consists of one 40 H.P. Robey engine and one 20 H.P. ditto (not in use), two Siemens's dynamos, each capable of providing 400 16-C.P. incandescent lights, equal to a total of 800 16-C.P. incandescent lights. 811 16-C.P. incandescent lights are now being used when in full work, or eleven more than the maximum quantity that the machinery provides for, so that if there is the slightest breakdown in any part of the machinery there is a total failure in the electric lighting of these important buildings.

The Borough Engineer makes the following recommendations and suggestions :—1. To make the engine and dynamo shed larger, so as to be able to get at the dynamo properly. The bed and holding down bolts of No. 2 dynamo are now so defective, and the vibration is so great when it is in full work, that it is positively dangerous and very injurious to the plant. 2. To move the dynamo to the place indicated on the plan and connect it up with the intermediate shafting, so that we could use either the 40 or the 20 H.P. engine. 3. To provide 60 E.P.S. 23 L accumulators or secondary batteries. By that means we shall always have a reserve in case of a breakdown; also, should there be only a small quantity of light required (say only one or two of the rooms, such as the free library or the banqueting room) we need not use the large 40 H.P. engine but the small one (thereby effecting a great saving in coal and cost of the electric lighting), or, in fact, without the necessity of running the engines at all in the case of a breakdown. By this means the Free Library could be always lighted by the electric light, which is a very desirable thing to do, in order to preserve the binding of the books. The present system is just as reasonable in its working as if a gas company attempted to supply gas without gas holders. I have estimated the cost to do this work as follows :—Alteration of shed for engine and dynamo, including bed with holding-down bolts, and to provide space for accumulators or secondary batteries, £60; cost of accumulators, £300; alteration of machinery, belts, &c., £180—total, £544.

This work might be done so as not to interfere with either the lighting of the Dome or the Pavilion separately; but it could not be managed so as to keep the whole installation going at once, without having a new dynamo, which would cost about £300, and, I think, be quite unnecessary. The proposed accumulators would be the greatest addition to the present plant, not only for safety and economy, but would allow of more lamps being added where necessary, and always ensure the electric light for the Lending Library. It must be distinctly understood that I do not recommend that any extra lighting should be done unless the accumulators are provided, and the alterations carried out. I think if this work is done, you will have one of the most complete electric light installations in this part of the country.

ELECTRIC LIGHTING IN ASIA.

As far as we are able to judge at the present moment there appears to be an excellent field open to electrical engineers in Asia, and this is now quite ripe for development. Only a short time ago a company was formed in China for the purpose of supplying electricity, chiefly for lighting purposes, and, if we remember rightly, a similar company has been constituted in Japan. In the former country the Emperor is said to be greatly in favour of the employment of electricity, and his Majesty has already adopted it as an illuminant in one of his palaces in preference to the lighting system generally in vogue in that empire. The Shah of Persia, too, is greatly interested in electric lighting, as was shown on the occasion of his recent visit to this country, and we believe his Majesty is about to have one of his palaces electrically lighted. In India the use of the electric light is making slow, but steady progress. Some of the petty monarchs have already adopted it, and others are considering the matter.

A short time ago the Harbour Trusts of Kurachi and Rangoon decided in favour of the use of electricity, and now the Calcutta Port Commissioners have followed their example. A proposal was recently brought forward by Messrs. Octavius Steel & Co., of Calcutta, who are the Indian agents for Messrs. R. E. Crompton and Co., of London (the latter being the proposed lighting company), to light the jetties, the Hooghly pontoon bridge and wharves by means of electricity. The Commissioners duly considered the proposal and, notwithstanding the fact that the change from gas to electric lighting will cause an additional expenditure of £200 per annum, they have resolved to adopt electricity as an illuminant. The reasons which have led the Commissioners to substitute electricity for gas are its superiority in illuminating power and immunity from the risk of fire for warehouse lighting, and they have granted a site at Pathoreah Ghaut for the erection of the engine and boiler house. The company is to furnish 42 2,000-C.P. arc lamps, which will be distributed as follows :—On the floating bridge, 10 lamps, each placed 100 yards apart; on the wharves from bridge to Chitpore, 20 lamps at intervals of 175 yards; and on the jetties and lower wharf to Baboo Ghaut, 12 lights, each being 135 yards from one another. The average number of hours when light will be supplied will be nine, and the price will be at the rate of two annas (2½d.) per lamp hour. The cost of lighting the same area at present by gas is about £1,530, whilst for electric illumination the expense will be nearly £1,730; but the amount of light to be furnished by the arc lamps will, according to the company's estimate, be nearly forty times that now supplied for illuminating the same area by gas. One of the chief advantages of the substitution of gas by electricity is that vessels will in future be able to discharge or load cargoes at night time, and for this purpose the company propose to put up connection boxes within and outside the jetty sheds, and in and on these will be placed movable arc lamps. At present, the unloading and taking in of cargoes at night time is only carried on under difficulties in consequence of the impossibility of gaslight being made suitable to all circumstances. For the offices glow lamps will be employed, and movable arc lamps will be placed on the vessels lying along the jetties and wharves. Messrs. Steel & Co. have proposed to the Public Ways Department of Bengal that they should light up the Calcutta maidans by electricity, but their offer has been declined.

Messrs. Crompton & Co. are, however, not going to carry everything before them, as there is another competitor in the same field, namely, the Anglo-American Brush Corporation. Some time ago the latter sent out Mr. R. P. Sellon to the East, and that gentleman has been endeavouring to secure business. He has visited, among other towns, those of Singapore and Penang, and is now on his way to Bangkok in Siam, where the king has given an order for the electric lighting of his palace on a large scale. Several of the Siamese princes and nobles have also decided to adopt the electric light, and the Brush Corporation's representative is to superintend the erection of the installations. The opposition to the employment of electricity in Asia does not appear to be so strong as that which obtains in Europe, and the only conclusion we can arrive at in the matter is that electrical engineers should be able to do a very profitable trade in the East, and for that purpose they should at once devote attention to the subject.

MAGNETIC LEAKAGE IN DYNAMOS.*

By Prof. H. S. CARHART.

IT is well known that certain forms of field magnets or their attachments favour leakage of lines of force more than others. The exact amount of such leakage I have determined in two cases, due in one to projecting steel and iron studs, and in the other to the iron bedplate. The two machines experimented on are of the Mather and Edison type respectively. The former is a small dynamo of from 400 to 500 watts capacity, and was built by a student in the physical laboratory; the latter is a No. 2 Edison machine of 5,000 watts capacity.

The field magnet of the small machine was cast in one piece, and the opening between the poles was bored out to a diameter of about 3½ inches. The leakage was due to four steel studs, at first used to support the brass yokes, forming bearings for the armature shaft, and to four small iron bolts by which the field magnet was attached to the wood base.

The steel studs were screwed into holes tapped out on the side of the pole pieces. Those on the pulley side were 3⅜ inches long, and those on the commutator side 5¾ inches. Each pair was 4½ inches apart. Their smallest diameter was ¾ inch, except the outer threaded end, which was slightly smaller. The bolts in the base were a little over 3 inches apart, 2½ inches long, and were made of ½-inch wrought iron.

These studs were all replaced with brass and the gain was determined by running the machine without a load, the voltmeter of 7,000 ohms resistance being connected across the terminals to measure potential difference. Two determinations were made: first, with the machine as a self-exciting shunt dynamo; and, second, when separately excited by a storage battery of 31 cells, giving 62½ volts at the time. The following table exhibits the results:

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* *Western Electrician.*

Studs.	Self-exciting.			Separately excited.		
	Speed.	Volts.	Per cent. gain.	Speed.	Volts.	Per cent. gain.
Steel	3,640	88·66	...	3,750	79·01	...
Brass	3,550	114·74	29·4	3,700	87·10	10·3

In both cases the speed with the brass studs was somewhat lower than when the iron ones were used. The gain will be perhaps better exhibited by estimating the total number of lines of force passing through the armature in the several cases. The voltage in the table has been corrected in the case of self-excitation, for the loss in the armature itself, due to the current required to excite the field. The voltage given is therefore the total E.M.F. generated in the armature; the loss in the voltmeter being so small as to be negligible. Using the formula found in Thomson's "Dynamo-Electric Machinery," p. 350, third edition, which is, $N = \frac{E \times 10^8}{n\,C}$, in which N is the total number of lines cut, E the E.M.F. generated, n the speed per second, and C the total number of wires on the armature, counting entirely round the periphery (in this case 768), we have for the two cases of self-excitation 190,000 and 252,000 lines respectively. The apparent gain is therefore 62,000 or 32·6 per cent. In other words, this small machine has its capacity increased 32·6 per cent. by substituting the brass studs for steel and iron. It would be an error, however, to suppose the leakage was actually 62,000 lines; for as the machine is self-exciting and the field magnet was magnetised much below the saturation point, any increase in the magnetic lines passing through the armature increased the E.M.F. generated, which in turn increased the ampère-turns round the field magnet. Thus a part of the 62,000 lines was due to this cumulative effect on the field.

This will be exhibited more clearly if we estimate the number of lines with the field separately excited. Applying the foregoing formula we have, for the iron and brass studs respectively, 164,600 and 184,100 lines. The gain in this case is 19,000 lines, or 11·2 per cent. This, therefore, represents the actual leakage through the steel and iron studs.

Two series of measurements of currents and E.M.F. were taken, first with iron studs and then with brass. The resulting characteristic curves exhibit throughout a difference similar to that estimated above.

In the Edison machine the iron bedplate is always appreciably magnetised when the field magnet is excited. This indicates some leakage through the $2\frac{5}{8}$-inch space between the pole pieces and the bedplate, which is filled in with zinc. The dynamo was dismounted, and was set on a base made of 2-inch pine plank, doubled and strongly screwed together. Care was taken to have a plane surface and to secure a proper alignment. The machine ran well on its extemporised base. No load was put on, the only current furnished being that necessary to produce its own field. At a speed of 1,760 revolutions per minute, the total E.M.F. generated with iron and wood base was 154 and 163·62 volts respectively. The total number of conductors round the armature is in this case 348. Therefore applying the formula there were 1,510,000 and 1,605,000 lines of force cut by the armature, or a gain of 95,000 lines by the removal of the cause of leakage, an increase of 6·25 per cent. It is not, of course, to be imagined that the efficiency of these machines is increased by any such per cent. as indicated by the gains due to removal of magnetic leakage. The capacity of the machines is increased by this amount, and a saving is certainly effected in two ways. One is the saving in material of construction for a machine of any required capacity; the other is the saving in energy required to produce the requisite field. Both of these items are of enough importance to be taken into account in designing a first class dynamo.

COMPARATIVE COST OF ELECTRICITY AND GAS.*

THE question as to whether the electric light costs more than gas light is one which has been raised on many occasions by different individuals, and is now being particularly discussed by the gas companies and corporations who propose to obtain powers to supply electrical energy in addition to their present gas business. The solution of the problem is not very difficult to find. On nearly all sides we hear it stated that the cost of the electric light is twice that of gas, but, as a rule, such statements are made without any actual knowledge of the expenditure required in putting up installations, and in their maintenance. The cost of the electric light, generally speaking, depends to a certain extent upon the size of the installation. We have seen many small installations, both in London and in the provinces, where they have been in operation for two or three years, and where, from figures given regarding the initial expenditure and the maintenance, it has been conclusively shown that the cost of electricity has not been in excess of that incurred for gas lighting. Indeed, we have in our mind's view at the moment several installations where the expenditure has been less, and even in cases where the number of lamps has not been more than 110 of 16-candle-power, or their equivalent. In one case a 10-horse-power Stockport gas engine is used to run a small dynamo supplying 95 16-candle-power glow lamps, and six 50-candle-power lights. This is in a large butcher's establishment. Formerly the whitewashing, painting, &c., which were necessary three or four times a year, owing to the gases given off by the combustion of coal-gas with the oxygen of the atmosphere, darkening and spoiling the shop ceilings and walls, were a serious item in the expenditure; but when the electric light had been adopted and had been in operation for two years, the ceilings and walls had not in the least deteriorated. This was due to the fact that the electric light—we are, of course, speaking of glow or incandescent lamps—cannot possibly give off any foul gases, because the light burns in a vacuum, that is to say, because the air in the glow lamps had been pumped out or exhausted in the process of manufacture.

In London, and we believe also in the provinces, the electric lighting companies are not permitted by the Board of Trade to charge a higher rate than 8d. per Board of Trade unit, which, as mentioned in a previous article, is equivalent to 6s. 8d. per 1,000 cubic feet of 16 candle-power gas. In the metropolis, as far as we are aware, the companies are charging almost the eightpenny rate, but in the provinces this figure is not always enforced. In one instance a company issued a circular stating that they would supply current at 4½d. per unit (1,000 watt hours). There is, of course, a great difference between 4½d, and 8d., but the company in question had in view the object of doing a large business with small profits, and a large total income rather than a small trade at high prices and a smaller aggregate income. The price of gas, as our readers are aware, varies in this country from about 2s. to 6s. 6d., and even 7s. per 1,000. Now, in towns where the higher prices prevail, it will be equally as cheap for the public to have the electric light as gas. It is not only in towns where gas is cheap that the gas companies and corporations should take up the supply of electricity, but especially in those districts where it is dear, and thereby obtain an additional income.

As some particulars regarding the relative cost of gas and the electric light may be interesting, we give below a table calculated on the basis of the Board of Trade unit at 8d. The table shows the cost of gas per 1,000 cubic feet at various prices, and the equivalent rate at which the unit would have to be supplied to be equal to the price of gas:—

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* *Gas and Water Review and Journal of Electric Lighting.*

Gas at per 1,000 cubic feet.		Price per unit for the electric light.
s. d.		d.
2 0	... ...	$2\frac{3}{8}$
2 3	... ...	$2\frac{11}{16}$
2 6	... ...	3
2 9	... ...	$3\frac{5}{16}$
3 0	... ...	$3\frac{5}{8}$
3 3	... ...	$3\frac{7}{8}$
3 6	... ...	$4\frac{3}{16}$
3 9	... ...	$4\frac{1}{2}$
4 0	... ...	$4\frac{11}{16}$
5 0	... ...	6
6 0	... ...	$7\frac{3}{16}$

As, however, the cost of producing one Board of Trade unit is, roughly speaking, generally estimated at $3\frac{3}{4}$d. per unit, it will be evident from the foregoing table that only in towns where the price of gas is in excess of 3s. 3d. per 1,000 will the electric light, as far as our present knowledge goes, be able to be supplied as cheaply as gas—although, as already stated in these columns, the price will not always be considered, as the public will have the electric light.

THE BIRMINGHAM EXHIBITION.

(*Continued from page 240.*)

The Lighting of the Building.—The "Tyne" dynamo, manufactured by Messrs. Ernest Scott & Co., of Newcastle, and used by them for lighting one of the bays with 6 3,000-C.P. Tyne arc lamps, is of novel construction.

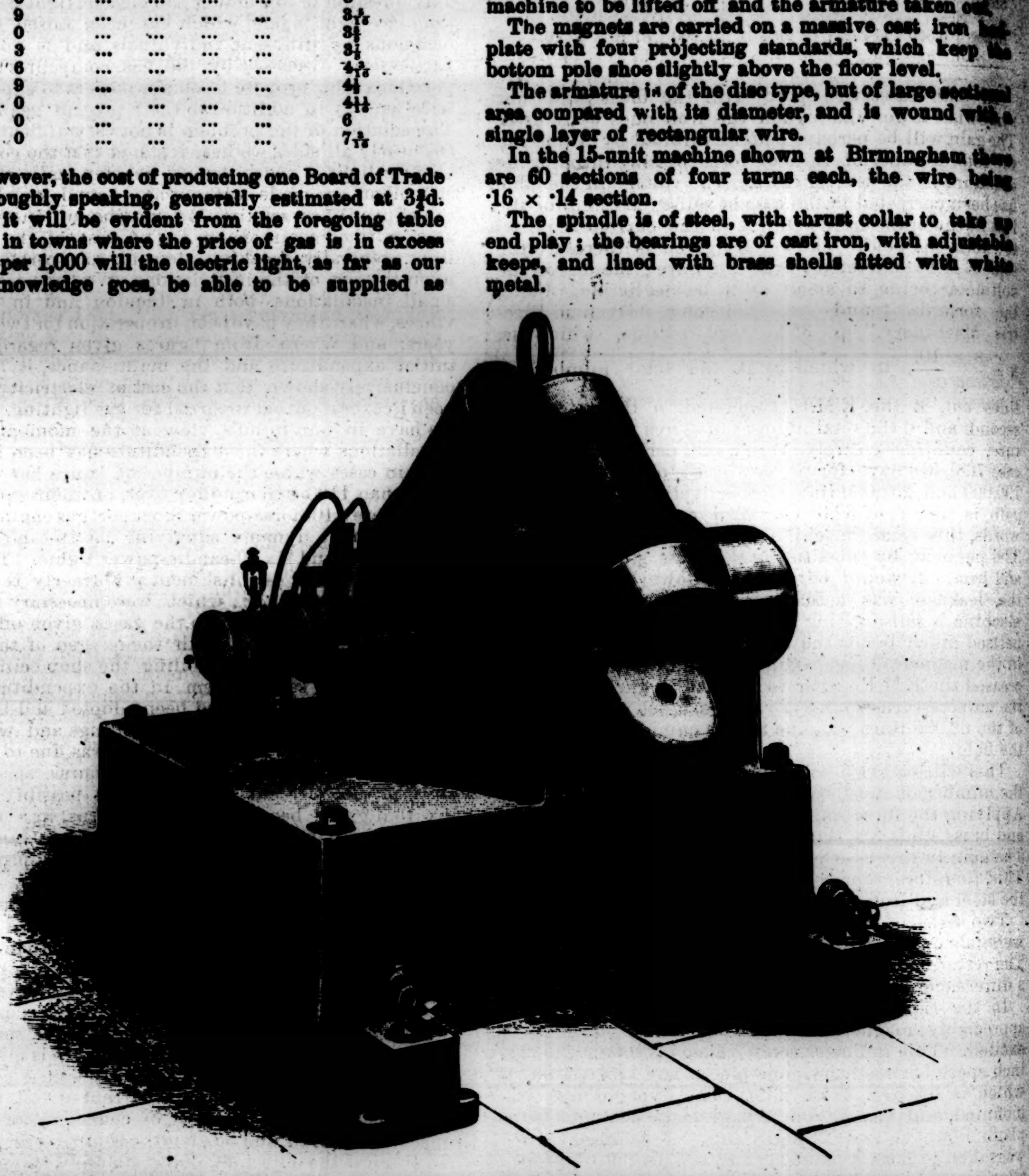
The machine has been designed by Mr. Mountain, and is now their adopted type for all sizes, from 3 units upwards, and it will be observed that the machine is of the 4-pole type, four magnets being arranged around the armature parallel to its circumference. The four magnet bars are of soft annealed wrought iron, and are joined together by four cast iron pole shoes; two of the pole shoes on the horizontal line are made in halves and bolted together, enabling the top half of the machine to be lifted off and the armature taken out.

The magnets are carried on a massive cast iron bed-plate with four projecting standards, which keep the bottom pole shoe slightly above the floor level.

The armature is of the disc type, but of large sectional area compared with its diameter, and is wound with a single layer of rectangular wire.

In the 15-unit machine shown at Birmingham there are 60 sections of four turns each, the wire being ·16 × ·14 section.

The spindle is of steel, with thrust collar to take up end play; the bearings are of cast iron, with adjustable keeps, and lined with brass shells fitted with white metal.



This construction has been adopted in preference to the ordinary method of running white metal into cast shells, as it enables new brasses to be fitted in at a moment's notice, it not being necessary to heat the bearing to melt out the metal.

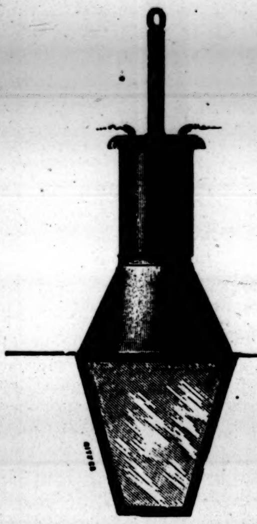
The white metal itself is of special quality, made by Messrs. Ernest Scott & Co., for their marine and other high-speed engines, and is stated to have double the wearing qualities of any other metal in the market.

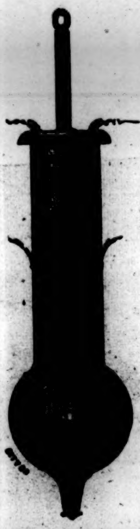
The commutator is of drawn copper, insulated by mica, and mounted upon a gun-metal sleeve secured to the spindle by locks, nuts, and a feather.

Owing to the powerful magnetic field of these dynamos, and the small resistance of the armature, the shunt machines are practically self-regulating. Throughout the construction of these dynamos the makers have endeavoured to combine thoroughly good electrical qualities with high mechanical efficiency, and, as an evidence of this, it will be observed that the machine runs absolutely without sparking or wear on the commutator, and perfectly steadily.

The "Tyne" arc lamp used for lighting the bays has also been designed by Mr. Mountain, and feeds by gravity. The upper carbon rod is cut in the form of a rack, and gears into a pinion carried on a spindle running in a sliding block in the inner frame of the lamp. This block is free to move vertically, and on the outside are two brake wheels. Upon the brake wheels there is a rocking lever carrying two friction chains. One end of the lever carries the iron core of the solenoid, and the other end the air dash.

When the current passes through the lamps the core is sucked up, tightening the friction chains upon the pulleys and raising the sliding block and thus striking the arc.





When the lamp is in its feeding position the sliding block rests on two adjustable stops, and as the current weakens in the solenoid the core is slightly lowered, releasing the friction chains and allowing the carbon rod to descend.

In practice it has been found that these lamps work perfectly well in moist or dry atmospheres, and that they will stand any amount of knocking about, and are thus eminently suited for all classes of arc lighting, and especially for factories or mills where they are subject to rough usuage.

The lamp is made in two types, viz., the globe, as shown at the Birmingham Exhibition, and the factory type with square lantern and reflector and an adjustable resistance coil for adjusting the E.M.F. at the terminals of the arc lamps is also shown in the engine room, and is of substantial and simple construction.

THE ELECTRIC TRAM LINE AT BUDA-PESTH.

[FROM A CORRESPONDENT.]

THIS day, September 5th, the second great line of the net of electric tramways belonging to the municipality, and designed by the firm of Siemens and Halske, was formally tested as to its admissibility, both from a technical point of view and from that of public safety.

After the steps to be taken had been agreed upon at the place of meeting, the commission proceeded first to the central station in the Gârtner St. (Ward VII.) Here was examined the central station for producing the electric current, the installation of special machines for working the new line, and the accessory cable conductors. The arrangement of this establishment, at once suitable and elegant, met with universal approbation. Especial notice was taken of the smokeless furnace, which is so perfectly constructed that the members of the municipal building commission and council pronounced it a pattern for similar undertakings in populous urban districts.

After the lapse of about a quarter of an hour the commission proceeded to the end of the Andrassy Road in the Town Wood, where is the terminus of the new electrical line.

The line begins at the Rudolf Quay, in front of the Hungarian Academy of Sciences, turns then with a curve of 27 metres radius into Széchény Street, and passes along it to the Frohner Hotel. So far the line is single, but it divides here and passes along Palatine Street to the new offices of the Department of Agriculture, and then in [illegible] Street is a double track to the premises of the Minister of Public Worship, formerly the station of the Western Railway. The line then leads along Woll Street, past the German Theatre, crosses the Waitzner Boulevard and the opening of the Grossenfeld Road and goes along Podmanitzky Street, until it crosses the Theresa Ring, still double. Here there is an arrangement of rails which is very interesting from a technical point of view. The lines of the electric tramways here cross each other, the two tracks of the Podmanitzky Street line crossing here and connecting with the double tracks of the Ring-Roads line, thus producing a very complicated net of rails.

After crossing the Theresa Ring the line passes along the outer Podmanitzky Street in a single track provided with the necessary places for meeting and passing. The line turns then with a curve of 35 metres radius, rising at the time 16 per 1,000 into the Arena Road, and leads along it to the opening of the Andrassy Road where it comes to an end, for the present, at the drinking fountain of the artesian well. The line, however, is to be continued from here to the park and up to the bridge of the artesian bath, having its terminus at the southern gate of the Palace of Industry. In the Arena Road there is, on a plot of land purchased for the undertaking, the well-equipped working station of the line, a substantial structure of masonry with iron roof and sheds for the tramcars and a well provided workshop for repairs, with the necessary lines and turntables.

At present there are five electric locomotives tastefully equipped ready for use, to which other cars can be coupled as the traffic may require.

The system of this electric line is that of Siemens and Halske, with underground leads for the current, as in the line formerly constructed in Station Street, and as in that about to be completed along the Great Ring Road.

The line was traversed three times by the Commission, all the details of the installation, the means of intercommunication, and the manner of working, being carefully tested in all their combinations. No objection was found, and the Commission declared unanimously that the concession for commencing regular traffic should be granted.

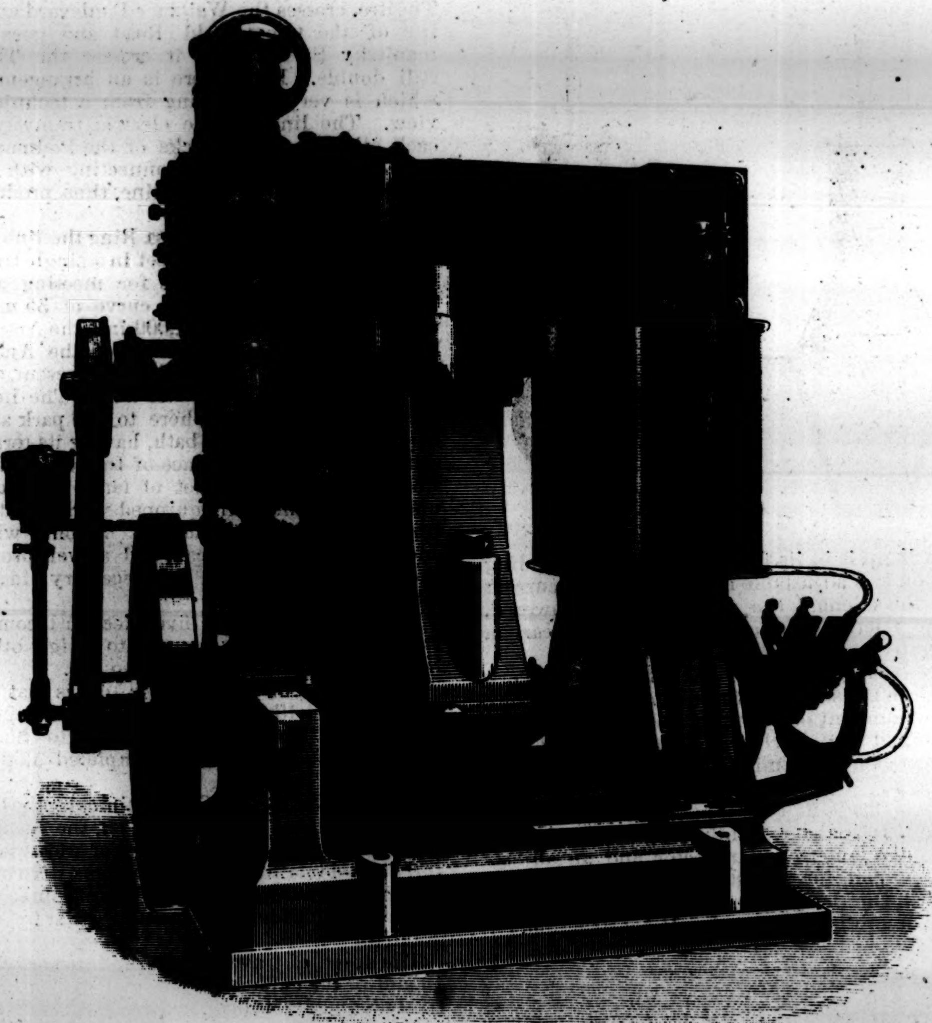
The speed of travelling in the interior of the town is 13 and in the suburbs 20 kilometres per hour (respectively 8 and 12½ miles).

The opening ceremony was attended by W. von Siemens, the son of the celebrated Werner von Siemens, of Berlin.

Electric Lighting Tenders Wanted.—The Municipal Council of Sydney, New South Wales, invite applications for the right to establish a system of electric lighting in the streets, lanes and reserves of that city, under the control of the Council. Such system may include the application of the light for domestic purposes, and the use of electric power generally. Upon a satisfactory system being submitted and approved, the Council will be prepared to enter into an agreement for the lighting of the whole or a section of the city, as may be considered advisable. Further particulars may be obtained at the offices of the Agent-General for New South Wales, 9, Victoria Street, Westminster, London, S.W

THE GWYNNE-COOPER STEAM DYNAMO.

We illustrate here a combined steam engine and dynamo, the joint patent of Mr. John Gwynne, of Messrs. J. and H. Gwynne, and Mr. C. F. Cooper, of Messrs. Paterson and Cooper. The construction of this machine is clearly shown by our engraving. The cast iron side frame of the engine is thickened up to form part of the magnet, an exciting coil being placed on the heavy bar of wrought iron standing vertically above the armature, which forms another part. The lower end of this bar constitutes one of the poles, the engine bedplate forming the other. The recess for the armature is bored out when the magnet bar is fixed in position, the two gunmetal side brackets seen in the illustration tying the latter firmly to the bed. The side frame, wrought bar, armature and bedplate thus constitute a complete magnetic circuit magnetised by a single coil.



The engraving has been executed from the photograph of a 50-light steam dynamo just completed. The engine is of the "Invincible" pattern, by J. and H. Gwynne, having a cylinder 5½ inches diameter and a stroke of 4½ inches. It is fitted with a Pickering governor and provided with arrangements for continuous lubrication. The electrical parts have been made by Paterson and Cooper, the armature being constructed as in their well-known "Phœnix" dynamos. In this machine the armature core has a diameter of 12 inches with an interior opening of 7 inches, and is 5 inches wide. It is Gramme wound in 36 sections, having each 12 convolutions of triple ·065 inch diam. wire. The magnet core has an area of 55 square inches, and the exciting coil is compound wound, with 132 turns of series wire ·220 inch in diameter and 1,710 turns of shunt wire ·065 inch diameter. The machine gives a current of 50 ampères at a difference of potentials of 65 volts, the speed being 470 revolutions per minute. There is no sparking visible at the brushes. It will be seen that the steam dynamo takes up very little room, and is therefore valuable for ship lighting or for use in situations where space is a consideration. In the machine shown, the armature is overhung outside the second main bearing, but in the larger sizes the commutator is placed between the second bearing and the armature, while a third outside bearing takes the place which in our illustration is occupied by the commutator.

INDIAN TELEGRAPHS.

From the *Gazette of India*, dated August 10th, we call the following information respecting the telegraphic appointments in that country :—

Telegraphs.

The 9th August, 1889.

No. 243.—Mr. W. H. M. Hare, Assistant Superintendent, Class V., first grade, Indian Telegraph Department, is appointed to officiate as a Superintendent in Class IV., with effect from July 22nd, 1889, and until further orders.

No. 246.—Sir Albert J. Leppoc Cappel, K.C.I.E., Director-General of Telegraphs, is permitted to retire from the service, with effect from the forenoon of July 1st, 1889.

No. 247.—The Governor-General in Council is pleased to make the following permanent promotions in the Indian Telegraph Department, with effect from the forenoon of July 1st, 1889, consequent on the retirement from the service of Sir Albert J. Leppoc Cappel, K.C.I.E., Director-General of Telegraphs :—

Name.	From	To
Colonel H. A. Mallock, B.S.C.	Deputy Director-General of Telegraphs, and Officiating Director-General of Telegraphs.	Director-General of Telegraphs.
Mr. W. R. Brooke	Director and Officiating Deputy Director-General of Telegraphs.	Deputy Director-General of Telegraphs.
Mr. C. H. Reynolds	Officiating Director and Superintendent, Class IV., 2nd Grade.	Director, Class III.

R. C. B. PEMBERTON, *Colonel, R.E.*
Secretary to the Government of India.

THE APPROACHING END OF ELECTROCUTION.

THE monotonous wrangle over execution by electricity still continues. The argument on behalf of the opposers is conducted with ever-increasing acrimony, while Mr. H. P. Brown's advocacy of the advantages of an alternating current for killing purposes is set down to any other motive but that of its effectiveness, and its superiority, on the score of humanity, over other methods of dealing the capital stroke. The discussion is a never ending one; it reminds one of the mechanical toy in which a train runs into a tunnel on one side only to emerge immediately afterwards from another tunnel on the opposite side; this procession of the same train in the toy, or the recapitulation of statements in the discussion, is equally wearisome. American readers must be quite as heartily sick of the whole controversy as we are, and it is somewhat surprising that the subject has not been tabooed long ago. Apparently there is not much chance of the matter dropping within a measureable limit of time, at least, not to anyone unacquainted with the various episodes throughout the contest; but to the initiated there comes a ray of hope that the end is drawing near. The argument has shifted considerably; it is now no longer a question as to the desirability of executing by electricity, and the most proper kind of current for doing so; it has degenerated into a combat between the advocates of the intermittent and the continuous current supply, in which Mr. Brown plays the part of an important fortress, whose guns must be silenced before the alternating current party can claim a victory. It is said that when argument fails abuse begins, and it is just here where the beginning of the end may be visible. It is stated that the entire list of experiments instituted by Mr. Brown was contrived for the sole purpose of bolstering up the continuous current companies at the expense of their rivals who supply the alternating current; that the direct current party supplied all the funds and paid their champion handsomely for his support, and that the letters published by the New York *Sun* conclusively prove that he is simply the paid tool in the Edison and Thomson-Houston interests.

Legitimate methods of attack must be somewhat exhausted when the solicitor of George Westinghouse, jun., descended to such vulgar abuse as to call his opponent "an unmitigated liar," and it would be curious to hear the language used by the rank-and-file; Billingsgate and the Irish biddies would surely be backseated.

It seems to be forgotten that the original contention of Mr. Brown was not only an onslaught against the alternating currents, but, one quite as determined, against the high potential continuous current, which latter was answerable for the lives of most of the victims from electric shocks. It was to be expected that the Edison Company would see the obvious value to itself in thus enlightening the general public on the dangers attendant on the use of currents of high potential; and the company cannot be blamed for utilising, to the best of its ability, the chance thrown in its way of showing the safety of the low tension current adopted under its own system. The opportunity was too good to be lost, and consequently its laboratory was placed at the disposal of Mr. Brown, and means provided for him to carry out his experiments in a satisfactory manner to himself and to the enhancement of the company's business. In the course of the experiments it became manifest that an alternating current, as the majority of electricians throughout the world believed and do believe, had a more prejudicial effect on the human frame than a continuous one of the same potential; it can scarcely be wondered at, then, that the proprietors of continuous, or so-called continuous, current systems should endeavour to derive some benefit from the facts made patent during the trials. This will account for such assistance as the Thomson-Houston Company gave in [illegible] Mr. Brown to challenge the Westinghouse Company to an electrical duel, in procuring him Westinghouse dynamos on favourable terms, and a promise of [illegible] to carry out some tests with those dynamos.

These facts came out in a series of 47 letters, published by the *Sun*, forming a correspondence with many people, extending from September last year up to July 18th of this year. It is passing strange how these letters, provided they are genuine, came into the possession of the above paper; it cannot have got hold of them with the consent of the owners of the originals; the probability is, therefore, that there has been some serious breach of trust on the part of *employés*, or, what is more likely, the letters have been stolen from Mr. Brown's office. Any way, the correspondence chiefly brings forward, in a prominent manner, that Mr. Brown had also an eye to business, and that, although he might be actuated in the first instance by philanthropy, he did not intend to allow virtue to be its own reward, not, at all events, when an alternative in the shape of a big advertisement, accompanied by plenty of dollars, was to be had. In one of the letters, he says, the December challenge to Westinghouse cost $275 for a single insertion in the *New York Herald*, *World*, the *Sun*, and the *Tribune*, and in each case the marks of "Adv." were omitted. The practice of advertisements appearing in the form of articles in American papers is so unusual that we are compelled to give implicit belief to the statement made by the *Sun* declaring the above accusation to be absolutely false. The correspondence occupies some six columns, and constitutes a batch of light literature such as the ordinary Sunday reader must have thoroughly enjoyed.

The report that Mr. Edison had an understanding with Mr. H. P. Brown that the latter was to work against the alternating current people appears to be unfounded, for, when Mr. Edison was examined before the City Referee, he testified there was no such arrangement; he had given a testimonial just as he would to any other man experienced in electrical matters.

From another source we learn that Mr. Charles F. Heinrichs, who made exhaustive researches on electrocide for the State, has some interesting views on the Westinghouse dynamo; he considers the alleged conspiracy against the Westinghouse Company to be all imagination. The scientific facts are that the Westinghouse high voltage alternating currents are dangerous to life, and the most suitable ones to serve electrocution causing the most instantaneous and painless death. No little surprise was caused by the evidence of the Westinghouse *employés*, in the Kemmler investigation, to the effect that they had received alternating currents of the full power of their machines, which amounted to many electrical H.P., and were none the worse, with the exception of some pain and slight wounds. Mr. Heinrichs thinks that these witnesses were painfully ignorant, or had wilfully perjured themselves, in which case they should be punished by subjecting them to the action of the powerful currents they claimed to have received. The medical profession look upon a faradic current of 300 volts potential, with a total energy of $\frac{1}{746}$th of a horse-power, sufficient to cause vertigo, and, if continued for a few seconds, to cause paralysis of the brain; hence an electrical energy of 746 times as much has always, and will always, produce instantaneous death.

Presuming the published correspondence to be genuine, the judge who has to decide on the constitutionality of the new law for electrical executions can hardly be influenced by the alleged disclosures it advances, and we trust that his decision may be the last word we shall ever hear on the worn-out argument.

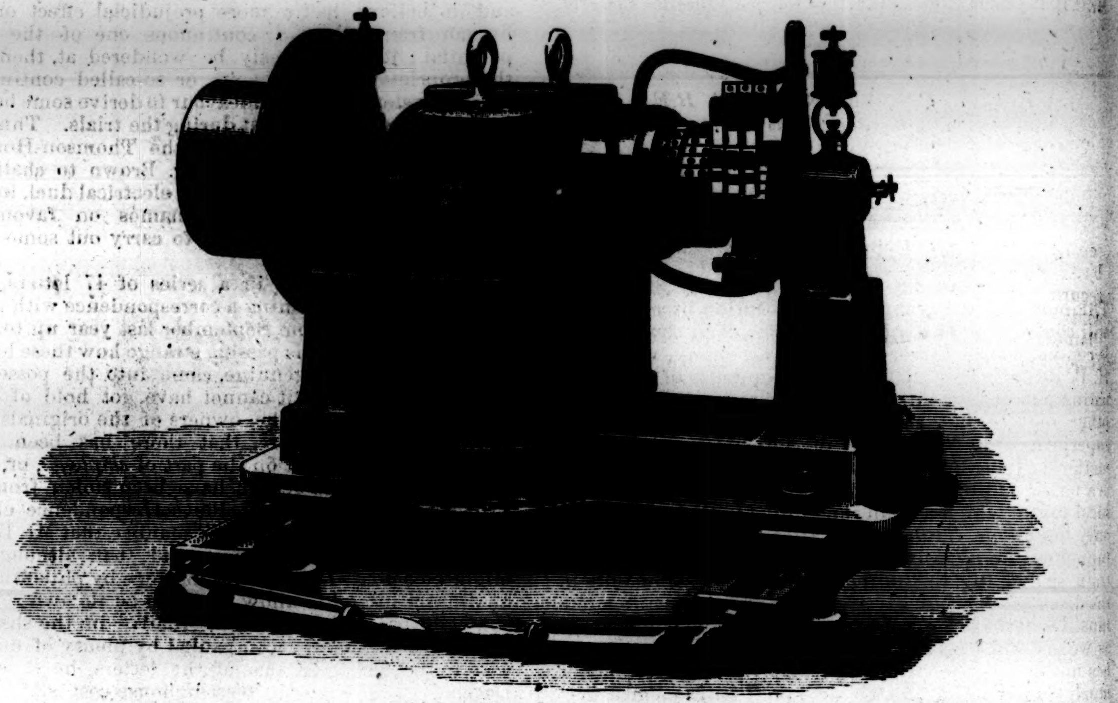


FIG. 1.

NOTES ON THE DYNAMOS AT THE PARIS EXHIBITION.

VII.

THE Société Alsacienne de Constructions Mécaniques, of Belfort, has probably the finest show of dynamos in the Exhibition. The normal type of machine shown in fig. 1 has a single horseshoe magnet and drum-wound armature, the largest exhibited being shunt-wound, and having an output of 60,000 watts at 330 revolutions per minute. The difference of potentials at the terminals of this machine is 120 volts, the current of 500 ampères being collected by four brushes one inch wide on each pole. The total weight is about 5 tons. The sections of the commutator are made of a very fine quality of iron, which has to undergo a certain degree of hardening, and there is no insulating material inserted in the spaces between them. The sections, as will be seen from our engraving, are overhung from one end being screwed to brass blocks, which terminate the ends of the armature coils. When they are all secured in place, they form a cylinder, having of necessity a clear space inside, so that no dust may lodge in the air insulating gaps and produce a short circuit. The field magnet cores are cylindrical bars of wrought iron, which pass right from the underside of the base plate to the top side of the pole pieces. These cores are turned to fit holes bored for their reception in the base plate, and are then firmly shrunk into place. The pole pieces are of cast iron.

This disposition of magnet cores and pole pieces has been arrived at as the result of a good deal of experiment. The wrought iron core, cast pole piece and armature are represented, according to the present method of building the machines, by A, B and C′, in fig. 2, the wrought iron being considerably cut into in boring out the polar cavity. But in the first designs of the Société the machines were made with pole pieces, B, fig. 3, wholly of cast iron, into which the wrought iron cores, A, did not enter. The pole pieces being so very massive, and cast iron having a high magnetic resistance, the effect of this disposition was to produce a very unsymmetrical field about the horizontal line, *a*, *b*, the distribution of the lines of force being probably as shown by the dotted lines. This unequal distribution was revealed by the abnormal heat produced at the bearings, when the machines were running with their magnets fully excited, an effect found eventually to be entirely due to the attraction of the magnets on the armature. By removing the bearings and supporting the armature by spring balances, this attraction was actually measured, and was found to produce on each bearing in a machine of similar output to the one above-described a pressure of no less than 1,500 pounds. It is satisfactory to know that the mode of construction now adopted gives a pressure on the bearings when the magnets are excited equal only to the weight of the armature itself. It may be therefore assumed that the lines of force in fig. 2 flow into the armature almost, if not quite, parallel to the line, *a*, *b*. That the machines are very efficient is proved by the fact that the armature of the 60,000-watt dynamo is driven at its normal speed of 330 revolutions as a motor by a current of 10 ampères flowing through it, when the field is excited so as to produce the normal E.M.F. This means that in Foucault currents in the armature core and conductors, in friction of bearings and friction of brushes there is wasted when running between 1,100 and 1,200 watts.

Occupying a prominent position amongst the exhibits of the Société is a directly-driven six-pole shunt dynamo, of the Siemens and Halske type, with internal radial magnets and external ring armature. The machine is driven by an Armington and Sims double-cylinder engine of 150 horse-power, running at 150 revolutions per minute, steam being supplied at a pressure of about 90 lbs. per square inch. The normal output of the machine at the above speed is 125,000 watts, the current being 1,000 ampères, and the difference of potentials 125 volts. Its total weight is about 7 tons. The armature core is built up of soft iron washers separated by insulating material, and is carried round by 18 brass bolts passing through it. These bolts are secured at the outside end to a star-shaped cast iron centre piece, keyed on the shaft. The armature has a diameter of about 7 feet 4 inches, and a width of 1 foot. It is, of course, Gramme-wound, but the conductors on the periphery form the commutator of the machine, and on them rest the collecting brushes. These commutator sections are of copper, 714 in number, and insulated from each other by paper. The current is collected by six sets of brushes covering the entire width of the commutator, alternate sets being joined in parallel. The brush holders are carried by a six-armed frame, which can be rotated to shift at once the angular position of all the brushes on the commutator, while by means of suitable gear they can also all be lifted off the commutator at the same time. The six radial magnets are of cast iron and are provided with pole pieces at their extremities. They are cast in one piece with a heavy central block which is bolted direct to the engine frame and bushed to form one of the bearings for the crank shaft. The machine is well finished, and is in all respects a creditable piece of engineering. This praise is also merited by the numerous appliances for regulation which the Société exhibit, but which we are unable to notice here.

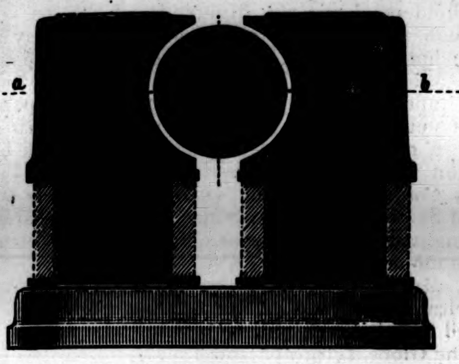


Fig. 2.

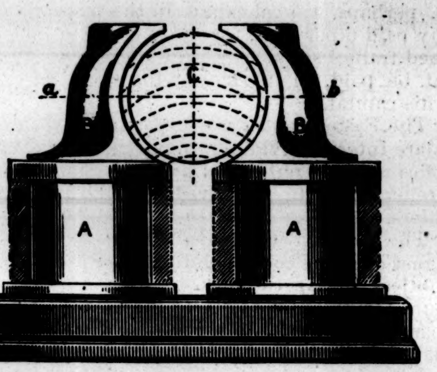


Fig. 3.

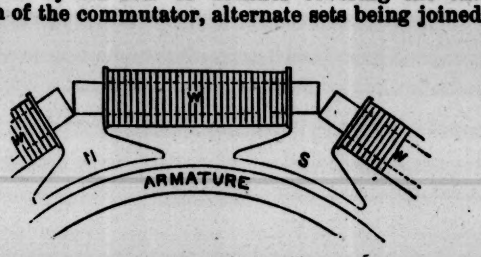


Fig. 4.

Messrs. Sautter, Lemonnier and Cie have an imposing exhibit of the projectors and lighthouse apparatus for which their house is justly celebrated. Several patterns of Gramme-wound dynamos are exhibited, amongst which is conspicuous an eight-pole machine coupled direct to a fast running engine. In this machine the field magnets are built round the armature by bolting rectangular wrought iron bars, W, fig. 4, to cast iron pole pieces, a ring magnet of octagonal shape being thus formed, of which part is shown. A magnetising coil is wound on each bar, the poles being alternately N and S, while the armature coils are cross connected, so that the current may be collected by two sets of brushes.

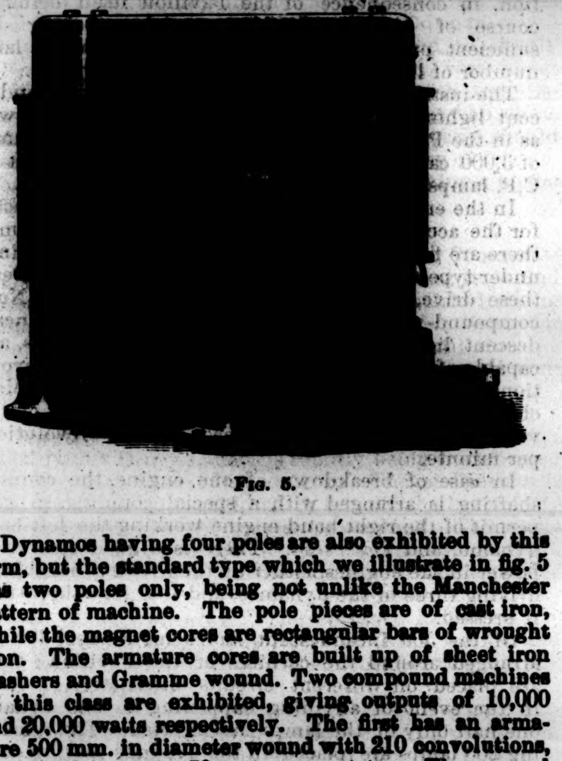


Fig. 5.

Dynamos having four poles are also exhibited by this firm, but the standard type which we illustrate in fig. 5 has two poles only, being not unlike the Manchester pattern of machine. The pole pieces are of cast iron, while the magnet cores are rectangular bars of wrought iron. The armature cores are built up of sheet iron washers and Gramme wound. Two compound machines of this class are exhibited, giving outputs of 10,000 and 20,000 watts respectively. The first has an armature 500 mm. in diameter wound with 210 convolutions, connected up to a 70-part commutator. The normal speed is 800 revolutions per minute, the current being 100 ampères at a difference of potentials of 105 volts. The resistances are :—Armature ·02 ohm ; series wire ·03 ohm ; shunt wire 6 ohms. The machine giving 20,000 watts has an armature 600 mm. in diameter, which is wound in 90 convolutions connected to a commutator having an equal number of sections. The normal speed is 550 revolutions, and the current is 300 ampères at 70 volts difference of potentials. The resistances of this machine are : Armature ·003 ohm ; series wire ·004 ohm ; shunt wire 14 ohms.

(*To be continued.*)

A Hope Deferred.—*Financial News* says :—"There is hope for travellers on the Southern railways. An Austrian railway official has invented a portable telephone for connecting a train, at any point at which it may stop, with the nearest station. If this were introduced into this country, business men who confide themselves for unknown periods of time to South-Eastern trains might be able to carry on their business during the hours of seclusion from the world entailed by such a journey."

CASTLE MONA, ISLE OF MAN.

AN installation of an important character has recently been successfully completed in Douglas, Isle of Man, at the well-known pleasure resort of Castle Mona. The hotel and grounds of Castle Mona, one of the most prominent points in Douglas Bay, were during last winter purchased at a high price by a syndicate, and it was determined to make the picturesque grounds, by the addition of a large Pavilion, more attractive to the large number of visitors who throng the island. Dancing and music are the favourite amusements of this place, and a Pavilion for this purpose was erected near the hotel on a larger scale than those already in existence at other points.

The syndicate determined to have this large Pavilion and the extensive grounds well lighted by electricity, and tenders were invited. That of the Manchester Edison-Swan Company, Limited, as we announced at the time, was, out of a large number, accepted. Some difficulty was experienced in carrying out the installation, in consequence of the Pavilion itself being in course of construction; but on the opening day sufficient progress had been made to allow of a large number of lights being used.

The installation is a mixed one of arc and incandescent lights, part of each being in the grounds, as well as in the Pavilion itself. There are in all 20 arc lamps of 3,000 candle-power each, and 500 incandescent 16 C.P. lamps.

In the engine-house, which has been specially erected for the accommodation of the engines and dynamos, there are fixed two 25-H.P. compound Robey engines, under-type, with locomotive multi-tubular boilers: these drive, by means of countershafting, two No. 5 compound-wound "Manchester" dynamos for incandescent lighting, each with an output of 100 volts, and capable of running 300 lamps at a speed of 800 revolutions per minute; and two No. 5 series-wound "Manchester" dynamos, each capable of an output of 600 volts and 20 ampères, at a speed of 1,100 revolutions per minute.

In case of breakdown of one engine, the countershafting is arranged with a special coupling, so as to permit of the right hand engine working the left-hand dynamo, and *vice versâ*. There is a good reserve of power in the engines, either of them being capable of driving three of the dynamos, and four for a short time, if pressed.

Of the 500 incandescent lamps mentioned, 300 are arranged around the cornices of the Pavilion; these are placed on different circuits alternately, so that in the event of anything happening to one dynamo one half only of the lamps are affected. The remaining 200 lamps are placed in the grounds in groups or festoons round rustic arches, having an excellent effect.

Of the 20 arc lamps, seven are suspended in the Pavilion, and the remainder fixed outside on latticed iron poles; the lamps inside the Pavilion are provided with a special ornamental corona, and suspended by their own conductors, which being arranged with counterbalance weights facilitates the raising and lowering. The arc lamps are placed in a manner similar to the incandescent, being fixed on alternate circuits.

The switchboard arrangement is very complete, there being double-pole switches on each circuit, and the connections are such that any change of circuit or dynamo or any combination can be easily and effectively carried out.

The whole of the arrangements have been devised by Mr. J. R. Williamson, M.I.E.E., the managing director of the Manchester Edison-Swan Company, who, assisted by his brother, Mr. A. F. Williamson, has given his personal attention and supervision to the work as it progressed, and enabled it, in spite of the many difficulties encountered, to be brought to a very complete and successful issue. The lighting of the Pavilion and the grounds of Castle Mona has given the greatest satisfaction, and rendered this latest place of amusement in Douglas a source of very great attraction.

SUBMARINE CABLE SHARES.

THE following letter appeared in the *Financial News* yesterday:—"The notification of the restoration of the Anglo-American Company's French cable, which was interrupted last July in deep water, affords another proof of the ease with which submarine cables may be repaired, and should impart confidence to the shareholders as to the permanent character of their property.

"The Anglo-American Company is now paying its shareholders quarterly dividends of 2¾ per cent., although for the whole year it may possibly pay 3 per cent.; but as the stock is quoted at £53, and the return at this price is only a little over 5 per cent., no immediate improvement in the quotation may be expected.

"The other Atlantic cable company whose shares are dealt in on the London market is in a much better position than it was formerly. The Direct United States Company is paying quarterly dividends at the rate of 3½ per cent. per annum. As the £20 shares can be bought at 10¾, an investor obtains about 6½ per cent. on his money.

"A dividend of 12s. 6d. or 15s. per cent. on Anglo-American stock, and of 3s. 6d. per share on Direct United States shares, will be payable next month.

"The Globe Telegraph and Trust Company will also declare a dividend in October. As this company's dividend for last year was 4⅝ per cent. when the Atlantic Cable Companies, in whose capitals the Globe Trust is largely interested, were for a part of the time working at a sixpenny tariff, it may safely be estimated that at least 5 or 5¼ per cent. will be paid for the current year, and at 8½, the present price, an investor obtains over 6 per cent.

"The West Coast of America Telegraph shares at 10½ are, perhaps, the cheapest in the market. This company paid 6 per cent. for 1888, and for 1889 the published traffics show very large increases. If only 7 per cent. be paid, an investor at 10½ would get £6 13s. 4d. on his capital.

"The Eastern and Eastern Extension Companies also declare interim dividends next month. The splendid traffics recently published by these companies ought to be reflected in an improved distribution to the shareholders.

"The Eastern Company's increase of £8,300 for August over the corresponding month of last year was, doubtless, in a great measure owing to the traffic with South Africa, which is a traffic capable of unlimited expansion, as fresh mining districts are opened up and progress is made in their development.

"I ought, perhaps, to add, with reference to the Anglo-American Telegraph Company, that the shareholders have a nest-egg in the shape of interest on their reserve fund. When the latter, which now amounts to £955,536, shall reach a total of £1,000,000, the interest is to be treated as revenue. This interest is now about £35,000 per annum, and on £1,000,000 it would not be much less than £40,000 per annum, giving the ordinary shareholders an extra 11s. 5d. per cent.; and as the preferred stock is practically already covered, yielding to the long-suffering 'A,' or deferred, shareholders a dividend of 1⅛ per cent., hence the 'A' stock has a prospective value which is perhaps hardly represented by the market price of 18.—I am, Sir, yours, &c.,

"A SUBMARINE CABLE SHAREHOLDER.

"London, *September 9th.*"

Shuffling Off this Mortal Coil.—Says the *Globe*:—"Following upon the discussion as to the name of the new electric executioner comes the question of what shall be the name of the death which the convict suffers. Various suggestions have been made, such as dyna-morti, electro-morti, electrocide, electrolethe, and others. The boldest which we have yet seen proposes that we shall say simply that the man has been 'browned.' Mr. Brown is the author of the electrical experiments in this matter, and he deserves at least an equal fame with Dr. Guillotin."

NOTES.

Electric Lighting at Hastings.—At a meeting of the Hastings Town Council, held last Friday, the Public Lighting Committee reported that they had received notices from the Local Electric Light Company and the South of England House-to-House Electricity Company of their intention to apply to the Board of Trade for provisional orders, authorising them to supply electricity for public and private purposes within the Borough. The Committee stated that the Board of Trade officials would give preference to the application of the local authorities in every case where, in the opinion of the Board, no special circumstances exist to render such preference inexpedient. The Committee also recommended that an application be made by the Council to the Board of Trade for a provisional order, authorising the supply of electricity by the Council for the lighting of streets or places and buildings under the control of the Council, the exact area of the supply to be determined by the Committee. Councillor Jenner moved the adoption of the report. The Deputy Town Clerk, in answer to a question, quoted £300 as the probable cost of obtaining a provisional order. Councillor Revill asked if private individuals required the electric light from the Council, would that body be bound to afford the supply or would it be optional? The Clerk said that the Council were only going to apply for power for public lighting. The report was agreed to.

Electric Lighting at Brighton.—At the last meeting of the Brighton Town Council the Pavilion Committee submitted their special report with reference to the electric light installation at the Pavilion. The Committee recommended "that the west wall of the engine house of the electric lighting station be removed and iron columns fixed to support the present roof; that a corrugated iron roof be carried over the present yard in accordance with the plan prepared by the Borough Surveyor, and that 60 accumulators or secondary batteries be provided and fixed and the necessary alterations made to the machinery, belts, &c., at an estimated cost of £544." Some opposition was offered to the report on the grounds that no engine was needed, as they had sufficient power without it, but on the motion of Councillor Booth the report was adopted. Further particulars respecting this may be seen in our other pages.

Electric Lighting in Sheffield.—A communication having been received by the Town Clerk from Mr. G. J. Simpson, intimating the intention of the Sheffield Telephone Exchange and Electric Light Company to apply to the Board of Trade for a licence to supply electricity to the borough, the Improvement Committee recommend the Council to reply to this as to a similar application, that they will not give their consent to any licence or provisional order being granted on the ground that the Council may probably themselves seek to obtain powers necessary for that purpose.

Electric Lighting for Harrogate.—A deputation waited upon the Corporation the other day with a view of laying before them the advisability of lighting Harrogate by electricity, and of their intention, providing the Council agreed to the project, of seeking Parliamentary powers to accomplish it. Mr. James gave a detailed statement as to the proposals of the projected company, and Mr. Emmott spoke in reference to the engineering section of the work. In answer to Councillor Ward, Mr. James said he thought the Board of Trade would compel them to run all their wires underground. Other details as to price, motive power, transmission of currents, &c., being considered, the deputation promised to forward to the Corporation printed particulars of their proposals at an early date. The deputation withdrew, and the Council rose.

The Electric Light at Falmouth.—At the annual meeting of the Falmouth Gas Company on Friday, the Chairman (Mr. R. M. Tweedy) stated that electric lighting was now making great strides, and it was thought that the time had come when steps should be taken to obtain powers to provide electric lighting, and to prevent an outside company coming in. The directors, therefore, proposed to apply for an Act of Parliament to include the necessary clauses for electric lighting. It would depend upon the consumers of the district whether such an Act would be worth having. If the people declined to take electricity, it would not do for the company to adopt it. The report having been agreed to, it was resolved that a dividend of 5 per cent. be declared, making 10 per cent. for the year. The Chairman next brought forward a resolution authorising the directors to make application to Parliament next session for an Act empowering the company to supply electricity for public and private purposes, remarking that of course they would not be obliged to take up the Act at once. Captain Harvey thought that if they did not apply for an Act others would. Replying to a question, the Chairman stated that an Act would cost about £500, and to supply electricity to the whole district would cost about £10,000. The resolution was carried with one dissentient, Mr. Turner, who would let those who chose make application, preferring that the company should remain as it was. He did not see the utility of swamping the company when it could go on making a moderate profit.

The Lighting of Fareham.—The Lighting Committee reported to the Local Board on Friday that steps had been taken for the formation of an electric lighting company, and recommended that the advertising for tenders for public lighting be postponed until after the next meeting, the committee in the meantime to continue their inquiries. The report was adopted.

Theatre Lighting.—According to the *Evening News and Post* "Drury Lane" is rapidly being transformed into a palace of dazzling delight. The auditorium is simply ablaze with gold, which sets off the beautifully painted ceiling to the greatest advantage. The whole of the passages, crush rooms, and corridors are part of a wonderful scheme of marble painting, in which marble of every hue and description is represented, and the effect is very striking. The entrance lobby will be turned into a most comfortable smoking lounge, and the whole house, both before and behind the curtain, will be lit by electricity.

Edinburgh and Electric Lighting.—At a meeting of Edinburgh Town Council, held on Monday, notices of the proposed applications by six electric lighting companies to Parliament for powers to light the city by electricity were submitted. Lord Provost Boyd said they should not allow power to pass out of their hands to light the city with electricity. The notices had been considered in committee, and he moved that the council refuse their consent to the applications, and remit the question generally to the Lord Provost's Committee with powers to support any action that might be taken by the Gas Commissioners. Mr. Colston, in seconding the motion, said it was the only thing they could do in the circumstances. The Town Council had no desire to retard the progress of electricity in the city, but at the same time they had no wish that these companies should acquire rights which the council would afterwards buy up at large cost. The motion was adopted.

Domestic Electric Lighting.—Major MacAlister, Glenbarr Abbey, Kintyre, is contemplating lighting his establishment by electricity. There is an ample water supply.

Inveraray Castle, the seat of the Duke of Argyll, is to be lighted by electricity. The necessary work is in progress.

Thames Steamboat Lighting.—In our leading article last week we omitted to mention that the names of the contractors for the electric lighting of the Victoria Steamboat Association's steamers are Messrs. Mackie and Chalmers.

Electric Light in Barnsley.—At a meeting of the Barnsley Town Council on Tuesday, a discussion ensued on the lighting of the borough, and the Town Clerk reported that notice had been received by the Lighting Committee from three companies of intended application to the Board of Trade for power to supply electricity in the borough. Since then he had had a letter from Messrs. Learoyd and James, solicitors to the National Electric Supply Company, stating that they represented thoroughly substantial people, and could receive any amount of pecuniary support. Ald. Brady said the subject was an important one; there were many subjects to enquire about, and he moved it be referred back to the committee to report. Ald. Brady said they might go further than Ald. Wood suggested. Their position was this—no company could come into the town to offer the electric light to the inhabitants without the permission of the local authority, and he believed they ought to offer every reasonable facility to those who were able to do it to supply the electric light. The question of public lamps was quite different. He was strongly of opinion that the Council should not apply for powers themselves, but they ought not to place an impediment in the way of public improvement coming to the town, which had already been too long delayed. In other towns tradesmen and private houses were supplied with the light, and they should seize the opportunity of having it brought to their own doors. He moved, "That the Town Clerk be directed to communicate with the gentlemen representing the Electrical Supply Association, and inform them that the Council will offer no opposition to their taking steps for supplying electric light within the boundaries of the borough, subject to such arrangements as the Lighting Committee may suggest to the Council." Eventually the matter was referred to the Lighting Committee, who were empowered to take such steps as they thought proper, and submit a report to next meeting.

The Electric Light in Glasgow.—A proposal by an electric lighting company to erect works in the town was considered at a meeting of Town Council, and by a majority of ten to three it was agreed to grant the facilities necessary for carrying out the work on condition that the price of supply is moderate, that the works are substantial, and that the Council have the option of purchasing the whole concern at the end of every seven years at valuation.

The Erection of Telephone Poles at Southampton.—At the last meeting of the Shirley and Freemantle Local Board of Health it was decided to accord permission to the Western Counties and South Wales Telephone Company to erect telephone poles in the Millbrook Road subject to the terms of an existing agreement and one or two suggestions from the Surveyor.

Telephonic Communication with London.—At the monthly meeting of the Prestbury (Cheshire) Highway Board, on Tuesday, an application was considered from the National Telephone (late Lancashire and Cheshire) Company for permission to erect poles carrying wires along the roads towards Congleton, from the Macclesfield boundary. The requisite permission was granted. This will now cover the space which will bring all Lancashire and Cheshire in direct communication with the Metropolis.

Repairing Cables.—The Anglo-American Telegraph Company's cable between Brest, France, and St. Pierre, Miquelon, laid in 1869 and broken in deep water on the 17th July last, was successfully repaired on the 5th inst., by the company's ss. *Minia*, Captain Trott, Commander.

Telegraphic Communication at Torquay.—At last Friday's sitting of the Torquay Local Board of Health, Dr. Richardson spoke of the inadequate telegraphic facilities at Torquay. He proposed that a memorial should be drawn up by the Board and forwarded to the Postmaster-General, asking that the General Telegraph Office might remain open all night, so that, in any case of emergency telegrams might be sent to any part. Mr. Allams seconded and the motion was carried.

Our Cousins across the Herring Pond.—Another of our valued Transatlantic exchanges feels bad. Says *Modern Light and Heat*:—"Our esteemed contemporary the London ELECTRICAL REVIEW is inclined to sneer at what the editor calls 'that latest American lunacy, the Electro-Automatic Transit Company of Baltimore,' which is developing the Weems's electric rapid transit system. Judged of from an English point of view the Weems's system may appear of a somewhat lunatic nature, just as a few years ago arc and incandescent lights did, and, as more recently still, electric railways and electric welding did, still they have all got there just the same. It may be the fact that this Weems's system is an American rather than an English invention, is rather hurtful to the feelings of the editor of the REVIEW. Well, we don't often have to record a brilliant and daring invention by an Englishman in the electrical field: such a genius is a *rara avis*. Still we have always pleasure in noticing any advances made by experts of whatever nationality, and while we refrain from recording our estimate of the Weems's system and its prospective utility, we prefer not to refer to it as 'that latest American lunacy.' We quietly await further developments with the fullest assurance that if there is anything practical in such a system of rapid traction, the skill, genius and pluck of an American rather than an Englishman will bring all that is practical out of it; and this, to the commercial and social advantage of the community and the well deserved profit of the inventor." This is a very good eulogy on "Yankee smartness," and does the modern one credit. Indeed, there is little to choose between the youthful aspirants to electrical literature and those of the more *ancien régime* so far as tall talk is concerned, and in this we freely yield the palm to American journalism. But, paraphrasing our worthy critic, we don't often have to record a brilliant and daring electric sugar fraud, a Keely motor swindle, or such a philanthropic, benevolent and humane idea as electrocution (see our other pages) emanating from the dense brain of the race to which we, through no fault of our own, belong. Our Boston mentor knows, as do all our exchanges, that more than ourselves nobody admires the untiring energy and the generally ingenious inventions of American engineers, and assuredly no journal outside their own country has accomplished more than the ELECTRICAL REVIEW in spreading abroad the results of their work, an assertion which many an inventor from the other side will endorse. When, however, we work our editorial selves up to that state of high tension which induces us to speak of what we consider nothing short of lunacy, we have generally a good recollection of previous work in the field upon which we dare to comment. There was a similar scheme devised by one, Danchell, and worked experimentally in this effete old island some years before the existence of *Modern Light and Heat*, and our personal experience of that now nearly forgotten 200 mile per hour electric railway warrants us in speaking as we did about the Weems's system. We did not need the assurance that if there is anything practical in it the skill, genius and pluck of an American rather than an Englishman will bring well deserved profit to the inventor, for we have seen too many instances of the latter result accruing from inventions which never possessed even the very desirable merit of practicability. Should our feelings have led us into betraying a too great warmth in replying to these Bostonian strictures, we trust that "the hub of the Universe" will not be slow in extending to us its pardon, for greatness and generosity should go hand-in-hand.

Higher Technical and Science School.—Sir Edmund Hay Currie has established at Folkestone a school for the training of pupils for such professions as require special scientific and technical knowledge, and there is to be a special course for those entering upon business life in the colonies and abroad. The matron of the school is Mrs. Beaufoy Merlin, who nine years ago started and organised the staff of ladies in the service of the United Telephone Company. Owing to changes, consequent upon the amalgamation, Mrs. Merlin resigned her appointment, and was recently presented with a very handsome gold bracelet and an address from the staff of ladies formerly under her superintendence.

Technical Instruction.—The Bill for providing a limited amount of technical instruction succeeded in passing the House of Commons on the 28th August, after encountering continued opposition from the objectors to aiding voluntary schools. The measure then went to the House of Lords and was passed through all its stages on the 29th ultimo.

Commercial Education.—The London Chamber of Commerce having ascertained, by careful inquiry, that a very large number of clerks trained in the excellent schools which exist on the continent are not only employed in the City of London, but obtain, on that account, a preference over our own countrymen, set to work to organise a scheme of studies and a system of examinations upon the results of which certificates could be granted by the Chamber. These certificates, it is believed, will come to be looked upon by employers as a valuable testimony to the knowledge and capabilities of the persons receiving them, and that the managers of commercial concerns will be the first to perceive that such steps are likely to result in real benefit to British commerce. The Chamber have now issued the scheme, with amendments in accordance with suggestions received, and make an urgent appeal for the co-operation of all interested.

The Edinburgh Exhibition.—We have received from the secretary of the International Exhibition of Electrical Engineering, General Inventions and Industries, to be held in Edinburgh in 1890, a plan of the building and grounds, and a map of the city, showing the situation of the buildings and the approaches. There will be both a North British and a Caledonian station at the exhibition, and it can also be conveniently reached by the suburban railway and by tramcars. To all appearance the site is a well chosen one, and the publication of this lithograph is a proof that the promoters are losing no time in perfecting their arrangements. The secretary's address is No. 40, Frederick Street, Edinburgh.

The Executive Council of the Edinburgh Electrical Exhibition have now prepared their catalogue. It is classed in three divisions, two of which again are divided into 22 sections, the third division being devoted to fine arts. These sections are divided into 120 classes. The divisions and sections are as follows:—Division I. Electrical engineering and inventions, in which are six sections, namely: Section 1. Productions of electricity. 2. Electrical conductors. 3. Measurements. 4. Application of electricity. 5. Bibliographic collection of works relating to electricity, plans, drawings, &c. 6. Historical collection. Division II. General Inventions and Industries, including 16 sections, viz.:—7. Mining and metallurgy. 8. Gold mining and production. 9. Rural industries. 10. Architecture. 11. Hygiene. 12. Decorative art, furniture and accessories. 13. Music. 14. Clothing and accessories. 15. Foods and drinks. 16. Education and liberal arts. 17. Engineering and machinery. 18. Navigation. 19. Chemical and allied industries. 20. Other manufactures and raw material. 21. Women's industries. 22. Artisans' industries. Arrangements are almost completed for the transfer of the entire Edison exhibit from the Paris Exhibition.

Electrical Plant.—We understand that the proprietors of *Electrical Plant* are arranging for more extensive premises for the exhibition and sale of all kinds of new and secondhand material, and that the business is developing into one of a most important character.

Electric Motive Power.—At the extensive new premises of Messrs. Rashleigh Phipps and Dawson in Berners Street, a feature of some interest will be the large use made of electro-motors and the entire absence of shafting.

Electric Railway Traffic.—The directors of the Vevey-Montreux Electrical Tramway Company give the number of passengers conveyed by it during the vinedressers' *fête* which took place recently:—

August	4	...	7,006 passengers	...	1,618 fr. 60 cents.
„	5	...	8,527 „	...	2,189 „ 70 „
„	6	...	8,510 „	...	2,233 „ 80 „
„	7	...	7,890 „	...	2,009 „ 20 „
„	8	...	10,308 „	...	2,912 „ 75 „
„	9	...	8,281 „	...	2,236 „ 55 „
„	10	...	5,269 „	...	1,277 „ 85 „
			55,786 passengers	...	14,478 fr. 45 cents.

The receipts were, on an average, 2,068 francs 35 centimes a day.

High-Falutin.—It is not the *Pall Mall Gazette* young man who has put his foot in it this time, but the one who is engaged on the *South Wales Echo*. This young gentleman, who goes into ecstasy over the electric lighting of the metropolis, states that "London night-by-night is to be no more; it is to be one continual round of daylight. All this is expected from electricity, which is even now being introduced into the streets, and will shortly break out in every district, putting the sickly, yellow light of the gas lamps to shame. . . . . Electricity has been tried at railway stations and at large places of business, but never on a great scale." We should advise this young man to read up a little before he again tries to enlighten his readers on matters electrical. When he has done so, he will doubtless have learned that electricity is not being introduced to the streets like a French roll in a baker's shop, always ready to have a piece cut off, as he seems to imagine. As to the large scale business, perhaps the *Echo* will send their young man to America to convince him of the fact.

Increasing Tractive Force.—A series of trials, with satisfactory results, has just been made on the Philadelphia and Reading Railroad, with an electric traction increaser for augmenting the tractive power of locomotives. The patentee of this invention is Mr. Elias E. Ries, of Baltimore, whose previous work in this direction has been brought before our readers. The invention consists of a small low-tension dynamo and engine, which are mounted upon the locomotive. The current from the dynamo is passed from the front to the rear driving wheels through that portion of the track lying between them, and this causes the friction between the wheels and the rails to increase. It is claimed that the friction is much greater than is the case where sand has been employed for increasing the "bite." The trials were made on the Frackville grade, 185 feet per mile. When the dynamo was run, and a train of 45 cars attached to the locomotive, the ascent was made in 28 minutes; but when the dynamo was not run, the same train required 55 minutes to go over the identical ground.

Railway Train Jolting.—It is stated that Professor Thomson, of electric welding fame, has perfected an invention by which the rails of street or steam railways may be welded together by electricity after being placed in position. A dynamo propels over the tracks an electric welding machine, which welds the rails into one continuous line after it passes over them. It is proposed to have at every 100 feet a break, to allow for expansion, &c.

The Electro-Harmonic Society.—We are requested by the honorary secretary to inform members that, should their communications to him not receive the usual prompt reply, it will be in consequence of his absence from home during the meeting of the British Association.

Important Notice.—We are informed that a well-known electrician is shortly about to deliver a series of lectures on dynamo construction. The announcements have not yet been made public, but we understand that a novel and important feature in the course will be the admission of professors at half-price in order that they may avail themselves of the much needed practical information of which so many of them now stand sadly in need.

The Paris Conference.—On page 265, at the end of last week's article on the Parisian Electrical Conference, for "dynamoter," read dynamometer.

Electricity in the Austrian Navy.—The Austrian man-of-war *Saida* is splendidly equipped with electrical appliances, including two powerful search lights, together with electrical devices which enable each individual gunner to fire his gun by pressing a button, or a whole broadside can be fired simultaneously from the captain's bridge by a similar arrangement.

Electric Cell-Calls Required.—The Receiver for the Metropolitan Police District is prepared to receive tenders for supplying, fixing, and maintaining electric cell-calls at police stations for three years from 1st October. Printed forms of tender, with full explanatory directions, may be obtained on personal application, or by letter, at the office of the Receiver, 4, Whitehall Place, S.W. No tender will be received after 12 noon on 21st inst.

Electric Bell Contract Going.—For making perfect and maintaining in thorough repair for a year the whole of the electric bells and wires, and the apparatus connected therewith fixed in the 59 land and river stations of the London Fire Brigade, and in houses used as lodgings for firemen, for the London County Council. Particulars may be obtained on application in the architect's department of the Council. Tenders to be sent in before 10 a.m. on the 26th inst.

The Training of the Electrical Engineer.—At University College, Bristol, a special course of study is arranged for pupils studying for the profession of electrical engineering, and for those who wish to include in their professional training some knowledge of electricity and its technical applications, especially with regard to electric lighting and transmission of power, telephones and telephonic systems, telegraphy, electroplating, &c. Many of the subjects of the general engineering course are included, together with electricity and magnetism, and practical instruction in the electrical laboratory. The student is reminded that an electrical engineer must, in addition to his knowledge of electricity, have a thorough acquaintance with practical engineering. A mere knowledge of testing and laboratory work is not sufficient to enable a student to become an electrical engineer. All who enter for this branch are therefore recommended to arrange with some firm, either of electrical or mechanical engineers, for a course of training in engineering works. Arrangements have lately been made whereby students will be enabled to spend one or two terms of six months in works during their college career.

Industries.—The chief office of our esteemed contemporary, *Industries*, is removed from Manchester to 358, Strand, London.

The Use of the Electro-Motor in Washington.—The motor, says the New York *Electrical Review*, is appreciated in Washington. Numbers of stores, restaurants, &c., have fans run by various kinds of electric motors. One or two printing offices use them to run their presses.

Charterhouse Science and Art Schools and Literary Institute.—The winter session of this, one of the largest Science and Art Schools in the United Kingdom, will commence on Saturday, September 28th, 1889, under the Presidency of the Rev. H. Swann, M.A. During the late session upwards of 1,200 students, mostly elementary teachers, availed themselves of the privileges afforded by this institution, and of this number about 750 presented themselves for examination, and were successful in obtaining a large number of first-class certificates, and also an unusually large number of honours certificates (in practical chemistry 13 took the honours paper, 5 obtained first-class honours, and 5 second—an unusually brilliant achievement), awarded by the Science and Art Department of South Kensington. Several students prepared for the Lond. B.Sc. (Int.) Exam.; most of whom highly distinguished themselves. Instruction of a practical character is given in most of the sciences at a very moderate fee, and in art at an equally low rate. Students, under the direction of five competent instructors, can be advanced in their studies. Those who have leisure can at a very moderate charge attend the day classes in art. Day classes will also be held to prepare candidates for matriculation (Lond.), the clerical, medical (including dental), legal, and other exams. Students who aim at becoming proficient in chemistry (organic and inorganic), have the opportunity of working in a well-fitted laboratory, capable of accommodating 60 students. Aspirants for university honours can, at a small expense, be assisted in their studies. Classes for matriculation, microscopy, Latin, Greek, French, German, shorthand, and music are taught by well-qualified teachers. Opportunities for the study of photography, &c., are to be continued this session. Full particulars of the classes may be obtained from Mr. C. Smith, organising secretary. Those interested in education will rejoice to learn that the work commenced by the Rev. William Rogers, M.A., now of St. Botolph, Bishopsgate, and ably continued by the late Rev. John Rodgers, M.A. (formerly a Vice-President of the London School Board), is so vigorously carried on by the present president.

Personal.—It is with much regret that we have to announce that Mr. J. R. Williamson, M.I.E.E., who has for a long time past occupied the position of managing director of the Manchester Edison-Swan Company, Limited, has been compelled by ill-health to relinquish his duties for the present. We understand that he is at once taking his departure for Australia, where he will be occupied in a similar capacity to that which he vacates, with a new company now being formed. Mr. Williamson takes away with him the best wishes of his fellow directors and his many friends, and we trust that the same amount of success which has attended him during his long connection with the Manchester Company may accompany him in his new career, and that the change may be thoroughly beneficial to his health. We may safely assert that the present position of the Manchester Edison-Swan Company, as a dividend-paying concern, is entirely due to the unremitting and successful exertions of Mr. Williamson, whose business capacity, first as manager and latterly as managing director, has been much valued and appreciated.

The Birmingham Exhibition.—The attendance at the Electrical Exhibition still continues to increase, and visitors are now beginning to understand the method adopted to work the various kinds of moving machinery by the electric current.

Marcel Deprez and the Electrical Transmission of Power.—At the last sitting of the Académie des Sciences the perpetual secretary mentioned, in the correspondence, a letter from M. Marcel Deprez relating to the recent lighting of the town of Bourganeuf. This electrical academician, says a French exchange, has taken the trouble to announce that the problem of the transmission of power by electricity might be considered as solved, on the fallacious pretext that the distance between the electrical works and the town of Bourganeuf is 14 kilometres. His modesty, perhaps, has made him forget the celebrated experiments at Creil; but he might have remembered the first practical demonstration of the transport of power by electricity furnished by Gaulard seven years ago. It is true that transformers have not enjoyed the privilege of being appreciated at their true value by M. Marcel Deprez, and that Gaulard died mad while M. Marcel Deprez became a member of the institute. Without wishing to disparage the installation of Bourganeuf we may be permitted to think that the experiment at Turin has had more fruitful consequences than the succession of abortive attempts of Miesbach-Munich, and lastly, of Creil, thanks to which the author: *Tomba de chute en chute au trône academique.*

The Engineering Chair in Glasgow University.—Among the candidates for the Chair of Civil Engineering and Mechanics in the University of Glasgow is Mr. J. A. Ewing, B.Sc., F.R.S., Professor of Engineering and Drawing in University College, Dundee. Mr. Ewing's previous work is well known to many of our readers.

A Find.—A correspondent of the *Manchester Guardian* writes:—"I hear that an electric lighting company, taking advantage of the present state of the Strand to lay its iron pipes, has made a very curious discovery. These pipes have to be carried to a considerable depth below both the gas and water pipes, and thus the workmen have come upon portions of the ancient wooden water-pipes of London, which have a bore of about 6 inches in diameter, apparently hollowed out of the trunk of a tree."

Designing Dynamos.—An American correspondent writes:—In reading Prof. Jamieson's article "On the Designing of Continuous Current Dynamo Machines," in the REVIEW of March 8th, I notice in the last formula on page 265 that you have:—

$$K_L = \frac{A \times T_{mw}}{2\,\frac{L_m}{S_m} + 1440\,\frac{2\,L_{as}}{S_{as}} \times \frac{L_a}{S_a}}.$$

Should it not read:

$$K_L = \frac{A \times T_{mw}}{2\,\frac{L_m}{S_m} + 1440\,\frac{2\,L_{as}}{S_{as}} + \frac{L_a}{S_a}}\ ?$$

Underground Wiring.—Says the *Western Morning News*, Piccadilly is following in the way of the Strand. The wires for the electric light are being pushed ahead beneath the wood paving, but things have been arranged in a sufficiently sensible a manner that the traffic is not greatly hindered. The great electric invasion is spreading in all directions. Streets are being torn up, and a stranger to town might well wonder what was the cause for the general chaos which prevails. The Strand will yet be the first of the London thoroughfares to have the electric light laid on at its houses from end to end, but the arrangements in Piccadilly will not take much longer in completing.

Electric Light Leads.—We have received from the Telegraph Manufacturing Company, of Helsby, a sample case of electric light leads of various gauges. The arrangement of the case, and its handiness for reference, are to be commended.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

West African Telegraph Company, Limited.—The annual return of this company, made up to the 16th July, was filed on the 7th inst. The nominal capital is £400,000, in £10 shares. 23,109 shares have been taken up and are fully paid. 20 share warrants, representing £1,200, are outstanding. The total amount of stock, for which share warrants comprising £5 stock each, are outstanding is, £3,650.

Electric Tramcar Syndicate, Limited.—The statutory return of this company, made up to the 5th inst., was filed on the same day. The nominal capital is £20,000, in £10 shares. 1,543 shares have been taken up, £13,000 being considered as paid up upon 1,300 shares. Upon the remaining 243 shares the full amount has been called; the calls paid amount to £2,400, and unpaid to £30. Registered office, 31, Lombard Street.

Brush Electrical Engineering Company, Limited.—An agreement of 12th July, filed on 5th inst., provides for the purchase by this company of the business of the Falcon Engine and Car Works, Limited. The new company will pay, satisfy, and discharge, all the debts and liabilities of the Falcon Company, and will fulfil all its contracts and engagements. The further consideration is £1,000, payable £500 in cash, and £500 by the issue of 100 fully paid £2 preference shares and 100 fully paid £3 ordinary shares. The residue of the consideration is the allotment to the liquidators of the Falcon Company or their nominees, of 11,000 fully paid up preference shares of £2 each, and 11,000 fully paid ordinary shares of £3 each.

An agreement of 16th August, filed on the 5th inst., is supplemental to the preceding, and stipulates that the principal agreement shall be binding upon the new company in the same manner as if the new company had been in existence at the date thereof, and as if the new company had been a party thereto in its own name in the place of Mr. Bertram Broadhurst its trustee, and Mr. Broadhurst is henceforth discharged from all liability under the principal agreement.

An agreement of 4th inst., filed on the 5th inst., between the Anglo-American Brush Electric Light Corporation and its liquidators of the one part and this company of the other part, relates to the transfer of the business and assets of the former company to the new company, the latter to discharge all debts and liabilities and to perform all contracts, &c. The purchase consideration is as follows: The issue of first mortgage debentures in the new company to a similar amount held in the old company, the issue to the shareholders of the old company of 52,314 fully paid-up £2 preference shares and 52,314 fully paid-up £3 ordinary shares. The agreement states that shortly after the confirmation of the resolution authorising reconstruction, Mr. Joseph Bevan Braithwaite met with an accident which has incapacitated him from acting as liquidator, and in consequence thereof, Mr. Edward Woods was appointed an additional liquidator by order of the Chancery Division of the High Court of Justice made on the 3rd inst.

Universal Automatic Advertiser Company, Limited (Mechanical, Electrical and General Engineers).—By a resolution of this company dated 21st ult., the capital has been increased by the addition thereto of £10,000 in £5 shares, beyond the registered capital of £10,000. The notice of increase was filed on the 22nd ult.

Column Printing Telegraph Company, Limited.—An agreement of 1st ult. provides for the purchase by this company from John Moore and J. E. Wright, of 5, New Bridge Street, of the following patents and provisional protection relating to printing telegraphs, viz.:—(1) Letters patent, dated 22nd December, 1887; (2) letters patent, dated 18th July, 1888; (3) provisional protection obtained for No. 2,413, date 11th February, 1889. The purchase consideration is 100 fully paid shares of £50 each.

Johannesburg Electricity Supply Company, Limited.—The registered office of this company is at 14, George Street, Mansion House.

CONTINENTAL NOTES.

[FROM A CORRESPONDENT.]

AT last the *Electric Light* has overstepped the Polar Circle! For the town of Hammerfest—the northernmost habitation and town in Europe, in lat. 70½° N., and almost at the foot of the North Cape—has decided upon establishing a central station for electric lighting. The subject is indeed one which might give a flight of fancy to a Jules Verne, when we think of that little northern town in the full glare of the sun for three months in the summer, and plunged in darkness for a corresponding period in winter, which now, we are happy to say, the great invention of the age will alleviate.

The Norwegian Government has decided upon dispatching Mr. H. Falsen, of Christiania, to Paris to study the latest progress in electrotechnical science.

At the end of June last the number of subscribers to the Christiania Telephone Company was 2,019, the number of apparatus in charge of the company being 2,275. The number of messages now average about 10,000 a-day.

A telephone net is to be laid from the town of Skien, on the Christiania fjord, to the province of Thelemarken, a somewhat extensive undertaking.

In consequence of the severe competition with the electric light the Christiania gas works have lowered the price of gas for lighting purposes from 17·5 to 15 öre per cubic meter, and from 15 to 10 öre for technical purposes, cooking, &c.

A large municipal central electric station is to be established in Copenhagen, plans for the same having been prepared by the city electrical engineer, M. Windfeld Hansen. The station will be modelled upon those at Deptford and in Hamburg, where M. Hansen has been studying.

The report of the Danish Telegraph Service for the financial year, 1888—89, shows that 553,281 inland messages were conveyed, 530,000 foreign ones, and 430,500 in transit to Scandinavia and Russia. In the previous year the figures were respectively 531,459, 456,000, and 363.330. The gross receipts of the two years were respectively £40,800 and £36,000.

Some interesting statistics have appeared in Germany respecting the use of gas motors in the principal towns, the proportion per 1,000 inhabitants being as follows: Hamburg 1·2, Cologne 2·4, Dresden 1·8, Leipzic 2·3, Breslau 0·9, Munich 2·0, Magdeburg 1·7, Barmen 2·2, Chemintz 1·6, Crefeld 1·9, and Augsburg 2·2. This shows a great increase of gas motors as compared with electrical ones in Germany of late.

A company has been formed in Berlin, styling itself the Berliner Accumulatoren Werk, the object of which is to manufacture Carren's accumulators. A considerable amount of capital has been sunk in the venture, and the promoters are sanguine of large profits. The plates in these accumulators are formed by two networks, the space between them being filled by the active material. The networks—web-like in construction—are laid upon each other, and soldered together in such a manner that the empty cavity in one corresponds with the filled one in the other. The composition of the paste, and the manufacture of the plates, is a secret, and a German technical journal asserts that the accumulators are not at all made by the method of the inventor whose name they bear.

At a recent meeting of the Société Internationale des Electriciens, M. Sénet communicated a paper explaining a simple and practical mode of coating porcelain with platinum (platinising), which will no doubt prove of great service in laboratories. Upon the porcelain being ready for the furnace it is covered with a layer of chloride of platinum—with the addition of a little spirits of salts in order to make it dissolve easily—or a combination of chloride of ammonia and platinum, but preferably the former, the porcelain is then exposed for 15 to 20 minutes in the furnace to a heat of from 1,000 to 1,200°. The heat reduces the chloride, and the metallic platinum becomes united with the porcelain. Upon repeating the process once or twice the coating is still better. The process will cause porcelain ware thus coated largely to replace the expensive platinum vessels now in use. In the same manner porcelain electrodes have been most successfully coated with platinum, the current acting well, and these electrodes should find a ready sale on account of their cheapness.

An interesting electrical installation has been completed, and is working exceedingly well at Messrs. Marrel's works at Rives-de-Gier, in the shape of a 120 ton crane worked by electricity. The dynamo supplying the current is of the Gramme type, and delivers 375 ampères at 120 volts. It is not only calculated to produce the force required for the motor, but also the current required for 18 Gramme arc lamps of 12 ampères each, arranged in nine parallel systems of two lamps each. The motor is a Gramme shunt machine of 230 ampères and 70 volts. The current is led through two copper wires of 100 millimetres diameter, being received from these conductors by the aid of two independent contact chariots, each fitted with five—three smaller and two larger—wheels with hollowed rolling surfaces. By the aid of a rheostat and an ingenious arrangement three different velocities may be imparted to the motor. The actual working of the crane is effected with leather belting and two cogwheels. The whole apparatus is working remarkably well, and is a very powerful one.

The new first-class carriages of the Paris-Lyons railway are lighted by electricity.

A new telegraph cable is to be laid from Ostend to the United States.

Between Vienna and Prague, a distance of 250 kilometres, a telephone service has been established.

The frequent accidents in mines through the use of fuses for firing dynamite cartridges have caused several electrical engineers to attempt to determine the firing of the same by electricity, and an Austro-Italian firm, Messrs. Schlesinger-Ruggieri, have patented some excellent apparatus to this end. The *matériel* consists of cartridges, cables, and hand machines (*coup de poing*). The cartridge may either contain dynamite alone or a compound of explosives enclosed in a metal tube open in front. Two copper wires connect the tube and the *coup de poing*, the latter being simply a small magnet dynamo, about 20 centimetres in height, similar to those constructed by M. de Meritens for the same purpose. To fire the mine a button is touched whereby a lever sets a system of cogwheels in motion. The armature rotates and a spark is emitted between the points of the copper wires leading into the cartridge, which is thus fired, and the mine explodes. The magneto dynamo is said to be very safe.

There has just been published in Paris an exceedingly interesting work by M. P. Clémenceau, engineer of arts and manufactures, forming part of the "Bibliotheque des Actualités Industrielle" (Bernard Tignal, éditeur, 5 francs) upon dynamo electrical machines from their earliest to their present types, with 116 illustrations. M. Clémenceau, who is an authority of great standing on the Continent on electrical matters, describes the most primitive as well as the most modern machines in existence, their history being, by the way, well illustrated *in natura* in the electrical section of the Paris Exhibition. The work is almost wholly descriptive, the theoretical part occupying but some few pages. The first part is devoted to Faraday and Pacinotti's attempts, describing the models that have now given place to the more perfect ones, whilst the second part deals with the most important types of machines now in use, viz., machines for single or alternating, current, magnets, disc, coil, and drum inductors, &c. Finally, there is an excellent chapter upon the erection and working of electrical machinery, plainly worded, so as to appeal to non-electricians.

For a year and a half, according to the *Annales de la Electricidad*, there have been observed on the subterranean section of the Marseilles cable leakages of current which increased daily. Fearing the total breakdown of the circuit, Mr. Brown, of the Direct Spanish Company, asked and obtained permission to replace the cables of this section. The company had laid down four, in case one of the two should be damaged, and in the present case the leakages or defects of insulation showed themselves in each. On May 21st, at 7 o'clock, Mr. Brown discovered four branch wires which, leaving the four cables, were directed towards the same house, following a wooden trench nearly high enough to allow of a man going through it on his knees. The four cables, some protected by a leaden sheath, and some by an iron one, had been attacked, and the branch wires attached to and leading from them had allowed of financial news sent from Paris being intercepted; but as there was no loss of continuity in the cables, it can only be asserted that a telephone served as a receiver. All search hitherto carried on has been unsuccessful in discovering the author of this fraudulent attempt.

We learn from Rome that, by order of the Ministry of War, all the forts of Vinadio, Tende, and Colle di Nava will soon be united by a special telegraph wire. The small detached forts will be connected by a telephonic line.

The directors of the Paris Exhibition have just taken a step which has been well received. The days having now become shorter, the hours for the playing of the fountains have been altered. They now play at 8, 8.40, and 9 on Sundays; the lighting of the Tower will also take place at 9.30, instead of 10.30. In connection with these alterations, the directors have decided to close the Exhibition half-an-hour earlier.

The most notable members of the Congress of Electricians last week visited the Forest and Châtean of Fontainebleau. M. Carnot invited them to a *déjeuner*, and the band of the School of Artillery gave them a serenade. Among those present we may mention: M. Mascart, member of the Institute; Sir William Thomson, Glasgow University; Mr. Preece, General Post Office; M. Rousseau, Professor at Brussels University; Ferraris, Professor at Turin; M. Kareis, Engineer-in-Chief to the Ministry of Trade, Vienna; M. Stoletow, Professor at the University of Moscow; M. Potier, Professor at the Polytechnique School; M. Joubert, General Secretary of the French Society of Physics; M. Lippmann, Member of the Institute; and M. Fribourg, directing engineer to the Telegraph Administration.

At the last meeting of the Paris Academy of Sciences, the Perpetual Secretary read a letter from M. Marcel Desprèz, stating that the transport of motive power had been in operation for three months at Bourganeuf, where it fed the public lighting with a machine of 100 horse-power, to which the power is transported from a distance of 14 kilomètres.

For some time past the telegraphists at the central office of the Northern Station, Brussels, have had their day's work increased from eight to ten hours. As may be imagined, the increase of work has caused considerable discontent among the telegraphists. The decision of M. Vandenpeereboom is, it appears, led up to by the fact that at this period of the year—the public having recourse to the telegraph service more than at any other—it is necessary to take extraordinary steps to expedite the business. And as, when the season is over, business resumes its habitual course, it has been preferred not to increase the staff, but to carry on the work with those ordinarily employed. "The measure of the Minister," says a Belgian contemporary, "is certainly open to discussion. It does not even appear to us practicable. The Minister would have acted more wisely in increasing the staff, the more so as the motive claimed appears to us as not all serious. Whence comes this increase of work in the dead season of politics and business? Probably from the holidays. But is it not compensated for by the reduction of political, commercial, and financial dispatches? When the winter comes, will they not find themselves face to face with an inverse compensation: many more business dispatches, many less pleasure telegrams? It will be objected that, if our observation be correct, the conclusion is equally unfavourable to the increase of the staff and the increase of the working hours. It is for the Administration to foresee, and we are not sufficiently *au fait* with its interior details to give an opinion on the subject."

INTERNATIONAL CONGRESS OF ELECTRICIANS HELD AT PARIS, 1889.

SESSION OF AUGUST 29TH, 1889.

First Section.—Units and Measures.

THIS section did not sit.

Commission of Units.

SESSION OF WEDNESDAY, AUGUST 28TH, AT 2 P.M.

The Commission proposed to the Congress for adoption the following resolutions:—

The practical unit of work is the *joule*. It is equal to 10^7 C.G.S. units of work. It is the work of a coulomb falling a volt.

The practical unit of power is the *watt*. It is equal to 10^7 C.G.S. units of power. The *watt* = 1 *joule* per second.

The Congress expressed the wish that in industrial practice powers should be expressed in kilowatts instead of in horse-powers.

Second Section.—Industrial Applications.

M. R. Arnoux presented some considerations on the experimental study of dynamos.

He showed that if we designate by F the effort at given point of the moveable part of a dynamo, by V the speed of displacement of this effort, E and I the electromotive force and the total current, the electrodynamic working of a machine may be represented by any one of four equations of three variables.

$$\phi_1 (F, V, I) = 0.$$
$$\phi_2 (E, V, I) = 0.$$
$$\phi_3 (E, F, V) = 0.$$
$$\phi_4 (E, F, I) = 0.$$

In other terms, the electro-dynamic properties of a machine may be represented by a certain surface as it is done in thermo-dynamics for the thermic properties of a body.

Among the four equations the only one which can be directly determined by experiment is ϕ_1; the three others, which contain the electromotive force, E, can be determined only by admitting that the law of Ohm is applicable to the internal circuit of the dynamo, which constitutes a *petitio principii*.

The surface, ϕ_1, will be very simply determined by experiment on allowing only two elements to vary at once.

This being established, if we admit that everything takes place in the circuits foreseen, the principle of the conservation of energy gives the relation

$$F V = E I$$

which, combined with one of the four preceding equations, supposed as known, enables us to determine the three others by a simple graphic construction. Hitherto the determination of no one of these surfaces has been effected in a sufficient manner. Experiment seems to have shown that the surface

$$F = \phi (I, V)$$

is not a cylindrical surface. On the other hand, Frölich finds that for one and the same current and one and the same speed the mechanical effect developed by a machine employed as a generator is superior to that developed when the same machine works as a recipient.

M. Arnoux considers that the differences observed may be due to the method employed for measuring the effort.

M. J. Laffargue spoke on electric canalisations. The study of such a canalisation may be divided into two heads: the study of the conductors in themselves, and that of their placing. For a distribution of 80 kilowatts (100 volts, 800 ampères) at a maximum distance of 300 metres from the works there are for two wires with five centres 1,525 kilos, or for three wires 556 kilos. The economy of the 3-wire system as compared with two wires varies from 60 to 68 per cent.

M. Turretini stated in studying a certain hydraulic question he had arrived at a solution interesting from an electrical point of view. The question was in arranging the utilisation of the motive power of the Rhône at Geneva to maintain a constant hydraulic pressure whilst a reservoir was being filled or emptied. This problem was solved by placing on the channel a centrifugal pump moved by a turbine driven directly by the water under the pressure of the channel. The apparatus has been working for two years, keeping up a constant pressure day and night. He thinks that in central stations worked with accumulators, an electric arrangement for collecting the loss of the charge of the accumulators whilst discharging would constitute an advance on the present system.

M. Ch. Jacquin exhibited an arrangement for measuring easily, day by day, the insulation of the nets of a central station.

He also gave an account of unpublished experiments carried out in simple cables for alternating currents, in order to determine the loss by induction, Foucault's currents and hysteresis in the armature of such a cable. A wattmeter with an alternating dynamo gave the total power, $P t d$, dissipated in the cables, and with a continuous current dynamo the power expended $R I^2$ in the conductor.

Third Section.—Telegraphy, Telephony, Signals.

M. Palaz read a paper on the relations of vicinity of telephonic and industrial nets. He drew the conclusions that industrial electric nets ought to have a complete metallic circuit, as well insulated as possible. The telephonic nets should be constructed of double wire, in order to permit the ulterior development of inter-urban telephony, and the simultaneous and undisturbed working of telephonic and industrial nets.

M. Vaschy gave some practical instructions on the effect of industrial wires upon telephonic nets. The effects are of two kinds: leakages and phenomena of induction. Leakages occur rarely, and are easily suppressed when the insulation of the wires is normal, and the distance of the wires is not below 1 metre. Induction may be produced either by continuous current dynamos or by alternating currents.

A vote was given in favour of the adoption of a double wire for urban and inter-urban telephone lines.

The President said that another question seemed to arise from the discussion, that of the regulation of industrial circuits. M. Vaschy thought that this question belonged rather to Section II., and M. Raymond was of opinion that it would be unjust to enforce a metallic closing in circuits for lighting or for the conveyance of motive power. Such an arrangement would interfere with the development of electric industry, which is of greater interest than that of the telephone. The section voted for adjournment.

M. d'Infreville called the attention of the section to the following method of utilising lines: He takes two circuits to form of them a new closed circuit, each of the original circuits constituting a wire of the new circuit, and so on. The system has not been applied in the United States.

M. Belugon said that the system in question had been laid before the Consultative Commission of Posts and Telegraphs, but had not yet been tried.

M. Piérard had tried the system with bad results. The current was bifurcated into several wires, having different currents of self-induction, and which consequently affected speech differently.

M. Mercadier described a *monotelephone* or *electromagnetic resounder*. Only the first harmonic is allowed to be produced. The diameter of the neutral line is $0{\cdot}68 \times D$, D being the diameter of the plate. Three holes are pierced into it, which may be introduced into the rods and fixed at will, and the bobbin may be more or less approximated to the vibrating plates.

SESSION OF THURSDAY, AUGUST 29TH, 1889.

M. Best brought for distribution a treatise on the applications of electricity in Mexico.

M. Chaye spoke on the utility of discovering an *indicating relay for submarine applications*. The best instrument is the telephone associated with the microphone. The microphone is placed in a watertight metal case or kept suspended in the water. In this manner the sounds of submarine explosions or the sounds of submerged bells might be recognised. A ship on her way might thus make known her presence in foggy weather, either by the mere fact of her movement or by means of signals. It would, however, be very useful to have an automatic indicator, which would supersede the necessity of constantly listening to the telephone.

In his experiments the author finds that three or four Leclanché telegraphic elements furnish the most convenient current for the apparatus and the circuits employed.

The microphones consist merely of one or two vibrating pencils of carbon, the variations of intensity of the current being relatively considerable.

To find the direction of the sound the microphonic plate is inclosed in a lead box with thick sides in which there is a window. On turning this box we perceive a maximum intensity as soon as the box is turned in the right direction.

M. Samuel read his paper on *Munier's Multiple Printing Telegraph*. M. Munier has come upon a practical arrangement for grouping several Hughes's apparatus in *multiplex* on the same wire. The number of contacts per apparatus is only seven (two of which go to earth) in place of 28, and the number of emissions per letter never exceeds two. Six letters are printed by a single emission of the current. The speed of the apparatus can be carried to a mean maximum of 150 rotations per minute. Hence with a quadruplex, 600 letters are produced per minute, in place of 180 as in the simple Hughes. M. Munier obtains these results by means of a new principle: *the principle of keys of fractionation*.

M. Dumont described his *electric disc*. A motor drives a vertical shaft which causes the disc to revolve by means of an endless chain. The mechanism is too complicated to be described here. The disc has been acting successfully at the Rainy station since 1886.

The President introduced the question whether five or three minutes should be taken as the unit of a telephonic conversation?

M. Banneux thought it necessary to distinguish between local conversations and those at great and very great distances. It is impossible to foresee *a priori* the value of the words *great distance*.

Major-General Webber asked if M. Banneux had any statistics on the influence of telephonic lines on the number of telegraphic messages?

M. Banneux, in reply, stated that he could not absolutely say whether the telephone had or had not injured the telegraph.

Fourth Section.—Electro-Physiology.

The section did not sit.

Supplement to the Proceedings of Wednesday, August 28th, 1889.

M. Trouvé presented a new machine for driving static electric machines. It requires to be turned by two men.

Communication.

A special invitation was given in by the Council of the American Institute of Electrical Engineers to attend a conference at New York in connection with an exhibition to be held there in 1892.

SESSION OF FRIDAY, AUGUST 30TH, 1889.

First Section.—Units and Measures.

M. Lippmann in the chair.

The Section approved the conclusions of the Commission of Units concerning the adoption of the watt and the joule as practical units of power and work.

M. Goldhammer, after having recapitulated the formulæ of M. Leduc and Mr. Tomlinson gave an account of his researches on nickel. The results obtained agree, as in the case of bismuth, with this law: the alteration of the resistance is proportional to the square of the intensity of magnetisation.

M. Huron dwelt on the relation between the variation of the resistance and the mechanical properties.

M. Stoletow summed up the results of his experiments on electric discharges caused by radiations (actino-electric phenomena), and added some critical remarks on the different hypothesis made to explain these phenomena.

M. Pilleux announced the following law:

If a thermo-electric couple is working between the temperatures, T and T′, if we call *k* the mean coefficient of variation of electric conductivity of one of two metals between the temperatures, T and T′, between which the couple works, and *k′* that of the other metal, we have:

$$E = (k - k') (T' - T),$$

E being the electromotive force of the couple.

He adduced numerous examples of the verification of this law.

Sir W. Thomson said that if we consider two or three pure metals, as, *e.g.*, iron, copper, silver, and an alloy like German silver, we do not find this law exact.

M. Marin made a communication on the movement of fluids and the applications to the theory of electricity.

M. Trouvelot presented photographs of electric sparks.

M. Gouré de Villemontée has examined the influence of gas in the equalisers of potential based on the fall of water. By the method of reduction to zero he has detected a very distinct influence of carbonic acid.

Sir W. Thomson said that this effect might be due to a modification of the surface of the metal by the action of the gas, and it is probable that the effect will be much greater with the active gases, oxygen or sulphuretted hydrogen, or by taking nitrogen on the one hand and oxygen or atmospheric air on the other. The polish of the surface must have an action in itself.

M. Drzewiecki showed the advantage of considering lines of force in place of the flow of force, for purposes of instruction.

M. Raverot said that when the absolute systems of the British Association were established they avoided taking force as a fundamental unit. As regards dimensions, there are, on the contrary, the usual dimensions of mechanical force (M, L, T), which serve as the point of departure. This contradiction arises from an investigation published in 1882 by Clausius, who, wishing to rectify the British Association system of electrostatic dimensions in accordance with the views of Ampère and the experiments of Rowland, has given a new system of dimensions. There has been a fourth system pointed out by Helmholtz to complete the series of possible alternatives.

M. Courtois presented photographs relating to the effect of the passage of the current in the wires.

M. Pellat said that to know the absolute precision of the electro-dynamometer it would be necessary to construct a second standard instrument of the kind which he had already produced.

Sir W. Thomson much wished that M. Pellat would make a second instrument to verify the former, and requested that the Congress should give a vote to this effect. This proposal was adopted unanimously.

Second Section.—Industrial Applications.

M. A. Potier in the chair.

M. Faure addressed a tribute of gratitude to the memory of Planté, and indicated his conception of a perfect accumulator. It is composed of two non-attackable plates uniformly covered with active matter. The active matter plays here also the part of conductor, and the portion which acts thus is five or six times as large as that which takes or furnishes oxygen. The heat resulting from the oxidation and the sulphatation of the reduced lead gives the measure of the maximum disposable energy, and all that takes place on the peroxidised plate merely diminishes the energy.

M. Hillaret insisted on the conicity of the cables of the so-called loop circuits for obtaining a constant difference of potential at the ends of the recipients.

M. Roux, on behalf of M. Raverot, presented a paper on compound machines and variable speed.

The installation of compound dynamos requires a special care by reason of the necessity of making them turn exactly at the speed for which the compoundage has been obtained by the constructor.

A means of utilising a compound dynamo presents a certain practical interest, and consists in a very simple electrical arrangement.

We may conceive naturally that by varying the derived resistance either by hand, or rather by the regulator of the motor, we should realise the regulation of the compound working with the desired precision. We will even add that this is the real method of regulation to be employed, the machine being compensated by construction for the smallest admissible speed.

M. Desrosiers asked how the regulation is obtained in the case of a single lamp. He had studied this question, and is in possession of a more complete arrangement which gives the full solution of the problem for considerable variations of speed.

M. Raverot replied that experience had confirmed his theory.

M. Ch. Jacquin, after having rapidly reviewed the representative curves of the working elements of alternating current machines without self-induction and with self-induction, and of transformers without iron, showed the curves relative to a transformer containing iron or the real transformer. These curves give the values of the working elements of a transformer of 7,500 watts—*i.e.*, the intensities, the powers furnished and expended, the yield, &c.—as a function of the time, the resistance and the yield of the secondary circuit. This latter curve is the most interesting, as it permits us to have characteristic curves of a transformer of any system and power whatever.

Prof. Forbes presented his current meter for continuous or alternating currents. The apparatus is composed of three parts—a conductor, a small windmill, and a system of toothed wheels. The conductor consists of two concentric rings connected by fine wires. The mill is entirely of mica. The heat liberated by the current in the conductor gives rise to currents of air by convection, which move the mill. There is no clockwork nor any variable contact in this meter, which is equally fit for continuous and variable currents of any speed. Another type is made with a small weight as motor, which communicates the movement to the apparatus for feeble currents. The type presented works with current of 3 to 36 ampères, and its resistance is 0·01 ohm. The maximum loss in volts is 0·4 volt.

M. E. Hospitalier, referring to alternating current machines, the use of which becomes more and more extended, without insisting on the creation of new names demanded as exact definition of the quantities

$$\sqrt{(E^2)} \text{ mean } \sqrt{(I^2)} \text{ mean and}$$

$$\sqrt{E^2 + \left(\frac{2 \pi L}{T}\right)^2}$$

and their corresponding units which are often met with in the study of alternating currents.

M. Decaux explained the results obtained by a series of experiments on the action of the electric light upon dyed tissues or upon pictures. The use of luminous electric sources will permit us to determine more easily the resistance of different colours to light.

Mr. Richard Frères exhibited several apparatus, an indicator of speed and various meters.

M. Kapp remarked that all the communications were of great interest, but that the object of the congress is chiefly to discuss on conventions and notations, and urged that the proposals made by M. Hospitalier should be discussed at once.

M. Naze, who had requested to give a communication on the Gaulard transformers, withdrew his demand, and distributed a pamphlet summarising the points he had intended to bring forward.

At the request of M. E. Boistel, the President expressed his opinion on the manner of explaining the reaction of the armature in machines. This reaction is determined by the default of symmetry of the magnetic field with reference to the line of brushes. The magnetic flux across a section of the armature is variable even in a machine at rest with the intensity of the current, I, which traverses this armature for every section other than those which are parallel or perpendicular to the axis of symmetry of the field.

The currents of Foucault and the retardations of magnetisation, or hysteresis, augment the reaction of the armature in the generating machine but diminish it in the recipients.

M. Potier proposes the formula $v : \sqrt{\frac{M\,W'}{W}}$ as the value of the magnetic system of a machine of the power W ; v is the linear velocity, W′ the power consumed by the excitation, and M the weight of copper of the inductor.

Second Session, in Evening.

M. Hospitalier urged the necessity of defining the following quantities and of giving them special names, as, also, the practical units derived from the C.G.S. which serve to measure them :

L, $\frac{L}{R}$ T, $\frac{1}{T}$, I mean, E mean, $\sqrt{(I^2)}$ mean, $\sqrt{(E^2)}$ mean,

$$\sqrt{R^2 + \left(\frac{2\pi L}{T}\right)^2}$$

After a discussion the Section resolved that :

The practical unity of the coefficient of induction is the quadrant. 1 quadrant = 10^9 units C.G.S.

It is useless to give a special name to the ratio $\frac{L}{R}$ which the authors designate as time constant.

The *period* is the duration of a complete oscillation.

The *frequence* is the number of periods per second.

The mean intensity of a current is defined by the ratio :

$$I \text{ mean} = \frac{1}{T}\int_0^T I\,d\,t.$$

The square root of the mean of the squares of intensity,

$$\sqrt{(I^2)} \text{ mean} = \frac{1}{T}\sqrt{\int_0^T I^2\,d\,t},$$

has not been able to receive a special name.

The following names have been proposed but have not been accepted by a sufficient majority : intensity, virtual, equivalent, mean, quadratic, practical, useful, effective, thermic, indicated.

The apparent resistance or fictitious resistance of a circuit is the factor by which we must multiply $\sqrt{(I^2)}$ mean to have $\sqrt{(E^2)}$ mean.

The President opened the discussion on the names of the poles of an accumulator, and the section resolved that in every accumulator the positive plate is that which is connected to the charging machine and which becomes the positive pole during the discharge.

Third Section.

M. Fribourg in the chair.

The subject of the length of a telephonic conversation was resumed. According to M. de la Touanne, in the circuit Paris-Brussels, there were from May 5th to May 15th, 285 conversations of less than three minutes, and 91 of more than three minutes. Hence he judged that a limit of three minutes is sufficient. It was suggested that conversations between persons at more than 15 kilometres from each other should be considered as interurban, and that the time for a conversation should be five minutes. M. Raymond proposed to reduce the time to three minutes, which was put to the vote and carried. It was also resolved that all telephonic communications should be considered as interurban if between subscribers or public offices forming part of different groups.

The President raised the question, should the number of successive conversations allowed to one person be limited ? The majority appeared to take the affirmative view.

Dr. J. Maier proposed the word *phone* to designate a telephonic message. M. Wenmann proposed the word *telepheme*, but no resolution was arrived at.

M. Wenmann handed in a paper on the influence of telephony on telegraphic activity. He contended that it was not sufficient to compare the total number of telegrams during the years before and subsequent to the introduction of the telephone. In a case of the system of annual subscription, the number of telegrams had decreased by 60 to 90 per cent.

M. Baudot gave an account of some recent improvements in his multiple printing telegraph. His new apparatus is to be seen at the Exhibition.

M. d'Infreville described a system which is patented neither in France nor England, and which gives very good results for annulling the disturbing action of neighbouring lines.

M. Bourdin applies the Gaulard and Gibbs transformers to telephony. He substitutes a small transformer for the bobbin of the microphone. He hopes thus to reduce the diameter of the inter-urban telephonic wires.

M. Dumont left at the office an account of his method of sending the time by telegraphic wires.

Fourth Section.—Electro-Physiology.

M. Trouvé presented an interrupter giving the same intensity to the induced current whatever the number of interruptions per second.

M. Wetzler made a communication on capital punishment by electricity. The best results are obtained by means of alternating currents.

M. Chavez read a memoir in which he attributed an important part in electrogenesis to capillary action, the part of which in osmose intervened independently of capillarity.

MM. Courtoy and Lagrange described in a communication the phenomena produced in conductors by the passage of the discharges of condensers.

At the general closing meeting held on August 31st, under the presidence of M. Mascart,

All the resolutions voted by the different sections were unanimously adopted, save the one of the third section which fixed the limit of time for a telephonic conversation at 3 minutes, which the Congress considered as having too administrative a character to be dealt with in full session.

M. Mascart finally delivered an eloquent address, in which he paid very prominent honour to Sir William Thomson.

ELECTRICAL STANDARDS.

Report of M. PELLAT

(*Master of the Conferences at the Faculté des Sciences, Paris*).

The most convenient method generally for obtaining the absolute value of a certain quantity consists in comparing this quantity to a *standard*, *i.e.*, to a quantity of the same kind equivalent to a unit or a known multiple of the unit. The choice of standards, and the determination of their value in absolute units, are consequently of the highest importance in exact measurements. Thus we can easily conceive how a certain conductor at a constant temperature may furnish a standard of resistance, how a certain condenser may furnish a standard of capacity ; but there are quantities, such as the intensity of a current or a quantity of electricity, of which it is difficult to have true standards. We get out of the difficulty in this case by means of apparatus which always give the same indication when they are traversed by a current of the same intensity, or by the discharge of the same quantity of electricity, and which, as they render the same service as a true standard, merit the name of *standard apparatus*. In electromagnetic measurements (the only ones that it is expedient to enter into here) there are only three quantities, the value of which can be obtained directly in absolute units. These are :—

1. The coefficients of mutual induction or of self-induction, the value of which can be obtained by simple measures of length (dimensions $[L]$).

2. The resistance of a conductor, the value of which may be given by measures of length and measures of time (dimensions $[L\,T^{-1}]$).

3. The intensity of a current, the value of which may be given by the measurement of a force and by measurements of ratios of lengths (dimensions $[F^{\frac{1}{2}}] = [L^{\frac{1}{2}}\,M^{\frac{1}{2}}\,T^{-1}]$). It is better to call the standards of these three quantities *principal standards*, since these are the only ones the value of which can conveniently be determined without having recourse to other electrical standards. In contradistinction, we will call *derived standards* the standards of the other electrical values, which, moreover, practically resolve themselves into standards of electromotive force and capacity.

PRINCIPAL STANDARDS.

1. *Standards of Coefficients of Mutual Induction or of Self-Induction.*

We will confine ourselves to remarking that it would be advantageous to have standards of coefficients of mutual induction, such standards not being as yet in existence, or, at any rate, not in use in laboratories.

2. *Standards of Resistance.*

At the International Conference of Electrical Units, in the first session in 1882, it was decided that a standard of resistance should be constructed equivalent to the ohm. Appeal was made to the *savants* of the various countries represented at the Conference to determine what length must be given to a column of mercury at 0°, having a section of 1 square millimetre, in order to represent the theoretical ohm (10^{-9} C.G.S. units).

During the second session, in 1884, the Conference, after having taken into consideration the reports made upon this subject,* fixed this length at 106 centimetres (?) ; *the standard ohm is the resistance of a column of mercury having a section of* 1 *square millimetre, and a length of* 106 *centimetres, at the temperature of melting ice.*

M. Benoit constructed, at the International Office of Weights and Measures, for the Administration of Posts and Telegraphs, four prototype standards in mercury representing the legal ohm.† These standards each consist of a rectilinear tube, having a section of about 1 square millimetre, debouching at its extremities into large vessels, containing, like the tube, very pure mercury ; the whole rests upon a plate of brass, which enables the apparatus to be plunged into melting ice, or into a bath of a known temperature. The glass tube was calibrated and gauged with all the exactness that it is possible to attain, and cut to the required length (taking into account the correction due to the expansion of the lines of force in the mercury of the vessels) in order that the standard might represent the legal ohm.

M. Benoit also constructed for the Administration of Posts and Telegraphs a large number of secondary standards formed of a glass tube bent five times, with vertical branches, and terminated by two large tubes forming a funnel, filled like the small tube with pure mercury. The resistance of these secondary standards was obtained by electrical comparisons with the prototype standards. It was these secondary standards that served to measure the metallic resistance of French manufacturers.

In England another method has been adopted. The specific resistance of mercury had been determined as a function of the ohm of the British Association (B.A.U.) by several physicists, amongst others, Lord Rayleigh and Mrs. Sidgwick.* From this datum, the committee of the British Association have taken :

1 legal ohm = 1·0112 B.A.U.

The English legal ohm has rather a higher resistance than the French legal ohm ; the difference is ·0005$^{\omega}$ according to the comparison made by Mr. R. T. Glazebrook.† In a recent study of the specific resistance of mercury, Messrs. Glazebrook and Fitzpatrick‡ have compared the prototype standards of the ohm of the British Association§ to the resistance of a column of mercury at 0° 1 millimetre in length, and having a section of 1 square millimetre. They found that the resistance of this mercurial column is equal to ·95352 B.A.U. ; consequently :

1 legal ohm = 1·0107 B.A.U.

According to this result, the English legal ohm would be too great by ·0005$^{\omega}$, and the French legal ohm would be quite accurate.

The Siemens and Halske standards of resistance,‖ which were constructed to represent the resistance of a column of mercury at 0°, one metre long, and having a section of one square millimetre, served as bases to the German constructors for obtaining the legal ohm ; they took :

1 legal ohm = 1·06 Siemens units.

The Siemens and Halske standard has been subjected to several comparisons with the mercurial standards of various experimentalists ; these are the results obtained :—

Date.	Experimentalists.	Value of the Siemens and Halske unit in a column of mercury at 0°, having a section of one square millimetre and a length of one metre.
1882	Lord Rayleigh and Mrs. Sidgwick	0·99949
1884	Roiti	0·99997
Idem	Mascart, de Nerville and Benoit	1·00003
Idem	Strecker (the mean for two Siemens standards) ...	1·00017

We see by this table that the Siemens and Halske standards agree well with other mercurial standards, taking into account the slight error which seems to exist, according to Messrs. Glazebrook and Fitzpatrick's experiments, in the experiments of Lord Rayleigh and Mrs. Sidgwick, which would bring the first figures on the table to a value almost equal to unity.

The average of the figures submitted to the Conference of 1844 for the length of the mercurial column representing the true ohm is 106·04. The figures given by the null method gave an average considerably lower than those furnished by other methods. M. Mascart¶ has shown since that this method admits of several corrections which had not been made, and which tended to raise the value. If the figures obtained by the null method are suppressed, the average is raised to 106·15. A sifting of the methods employed would raise the figures still higher and bring it to 106·25.

Since 1884, a large number of other determinations of the ohm have almost all concurred in furnishing figures approximating to 106·3 (the number submitted to the Conference of 1884 by Messrs. Mascart, de Nerville and Benoit, by Mr. Glazebrook and by Lord Rayleigh was 106·28). Amongst these experiments we may mention those of Mr. Rowland,* made under eminently favourable conditions, and which gave the figures 106·32; those of M. F. Kohlrausch,† 106·32, and the quite recent experiments of M. Dom,‡ 106·24, made by the null method, but with the necessary corrections made; the experiments of M. Wuilleumier,§ 106·27, made by the excellent modification of the Lorenz method indicated by M. Lippmann.

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* Proceedings of the International Conference for the Determination of Electrical Units, p. 43.

† Construction of prototype standards of electrical resistance of the Administration of Posts and Telegraphs, by Réné Benoit (Gauthier Villars, 1885.)

* "On the Specific Resistance of Mercury," *Chemical News*, No. 1,172 (May, 1882) ; *Phil. Trans.*, Part I. (1883).

† "A Comparison of the Standard Resistance Coil, &c.," *Phil. Mag.*, 5th series, Vol. XX., p. 343 (1885).

‡ "On the Specific Resistance of Mercury," *Phil. Trans.* Vol. 179 (1888).

§ These standards, to the number of eight, are deposited at the *Cavendish Laboratory* at Cambridge.

‖ The mercurial standards of M. Siemens were first constructed in 1868. In 1881—2, the old standards having nearly all disappeared through accidents, a very careful reconstruction of the mercurial standards was made with rectilinear tubes of glass gauged and calibrated by the *Imperial Committee of Weights and Measures*, at Berlin. It is these new standards that are here designated by the name of the *Siemens and Halske standards*.

¶ "Journal de Physique," 2nd Series, Vol. IV., p. 101 (1885).

To sum up, these different measurements concur in showing that by taking 106·3 as the length of the column of mercury representing the theoretical ohm, we shall probably only commit an error of less than $\frac{1}{3000}$th.

3. *Standards of Intensity of Current.*

Most frequently the intensity of an electric current is measured into an absolute value by one of the three following methods: 1st, by the tangent galvanometer; 2nd, by M. F. Kohlrausch's method; 3rd, by electro-dynamometers, and especially balance electro-dynamometers. These last instruments give the intensity of the current by a weight, by the help of the formula $i = A \sqrt{p\, g}$, in which p represents the number of grammes required for the weight ($p\, g$) to make equilibrium with the electro-dynamic force, and A a constant depending on the form of the instrument and determined by measures of length; these latter could be made with an arbitrary unit, since only ratios of length enter into the expression of A. Thus the balance electro-dynamometers come under the category of standard apparatus. Moreover, by the simplicity of the measurement, we can, with these instruments, obtain a degree of accuracy higher than that given by the other methods.

Messrs. Joule, Cazin, Mascart, Helmholtz, &c., have constructed balance electro-dynamometers with a view to particular researches; each of these instruments might have been considered as a prototype standard, but no copy has been made of them.

There are, however, in existence standard apparatus giving in absolute value the intensity of a current. Sir W. Thomson is the inventor of a series of balance electro-dynamometers intended, some for measurements of currents of low intensity (milli-ampère, centi-ampère), and others for the measurement of currents of mean intensity (deci-ampère, ampère) or currents of high intensity (hecto-ampère, kilo-ampère). These instruments are widely known in England and in a few other countries.

In France, M. Pellat‖ has had a balance electro-dynamometer constructed by M. Carpentier, which differs from those employed up to that time in that the small bobbin with vertical axis forms one body with the beam of the balance, and is placed in the midst of a long horizontal bobbin. The small bobbin having only a single layer of fine wire, and being far from the ends of the large bobbin, the irregularities of winding, which are always produced at the ends of a bobbin with several layers of wire, are here without influence. The measurements of length necessary in order to determine the constant, A, of the apparatus were made at the instance of the International Bureau of Weights and Measures. Supposing all the possible errors of the dfferent measurements to be added up numerically, we find that the error in the constant, A, does not exceed $\frac{1}{3000}$th. The error in the weights is, moreover, much less.

M. Pellat* has also had copies of his absolute electro-dynamometer constructed by M. Carpentier, to which he has given the name of standard ampère; they only differ from this last instrument in that the movable bobbin bears several layers of wire, and that the fixed bobbin is much shorter. The constant, A, of the standard ampères is determined by comparison with the absolute electro-dynamometer; this determination is made with an exactitude of $\frac{1}{10000}$th. The constant, A, is, moreover, absolutely independent of the temperature.

DERIVED STANDARDS.

1. *Standards of Electromotive Force.*

A standard of electromotive force is constituted by an element of a battery. The difference of potential between the two poles of the battery in an open circuit, which measures its electromotive force, is determined in absolute value by comparison with the difference of potential, e, that exists at the two ends of a known resistance, r, traversed by a current of known intensity, i ($e = i\, r$). The comparison can be made either by the charge of a condenser or, which is much more exact, by opposing the element of the battery to the electromotive force developed at the two ends of the resistance by the passage of the current, and making this latter vary until the two electromotive forces are equal. Unfortunately, no element of a battery studied by the exact method that we have just indicated possesses an electromotive force that is absolutely invariable with the time.

The standards usually employed are the Daniell sulphate of copper element or its various modifications (Callaud battery, Post Office standard, &c.), the Latimer-Clark element of mercurial sulphate, and the Gouy element of binoxide of mercury.

Unless excessive precautions are taken in its construction and preservation,† the Daniell element cannot serve as a standard in measurements of great precision. The electromotive force of various elements constructed in the same manner, but with material derived from different sources, may vary from 1·06 to 1·14 v at least. And, what is still more serious, the same element, when once mounted, does not maintain an invariable electromotive force owing to the inevitable alterations in the surface of the metals. The best means of getting a Daniell cell with an almost constant electromotive force consists in mounting the element with new solutions before using it, and closing the circuit for a little while, so as to coat the electrode with copper; the circuit must be opened a few minutes before taking the measurement. The Latimer-Clark and Gouy elements, in which pure amalgamated zinc and mercury serve as electrodes, are far preferable, the metals not being altered, or at least the alteration which takes place after a long time on the surface of the zinc not modifying the electromotive force. The Latimer-Clark element may be constructed in two different ways: (1) by employing as electrolyte a paste formed of mercurial sulphate imbibed from a solution of sulphate of zinc; (2) by employing a weak solution (15 p., 100 for example) of sulphate of zinc and depositing mercurial sulphate in a powder on the surface of the mercury.‡

According to the unpublished researches of Messrs. Potier and Pellat, the liquid Latimer-Clark element (1·465 v. on an average) is preferable, for many reasons, to the Latimer-Clark element with the electrolyte in the form of a paste; the electromotive force is less variable with the time; the coefficient of variation with the temperature is about half as great, and the temperature can be known exactly, which is impossible with a pasty electrolyte; lastly, the element is much more conductive, and is only polarised very little by the passage of the current. Several liquid Latimer-Clark elements constructed at the same time do not, as a rule, vary more than $\frac{1}{1000}$th of their mean value at the same temperature, unless, by accident, the mercury should have touched the zinc; traces of zinc in the mercury tend to diminish considerably the electromotive force; in fact, this latter may even be annihilated or reversed.

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* These experiments were communicated in 1887 to the British Association at Manchester.

† "Abhandl. der k. bayer. Akad. der Wissench." 2nd Class, Vol. 16.

‡ The Academy of Sciences at Berlin, July 5th, 1888.

§ *Comptes Rendus de l'Académie des Sciences*, June 4, 1888.

‖ Comptes Rendus de l'Académie des Sciences (December 13th, 1886), *Journal de Physique*, 2nd Series, Vol. VI., p. 175.

* "Bulletin de la Société Internationale des Electriciens." Vol. V. (May, 1888).

† See on this subject the work of J. A. Fleming, "On the Use of Daniell's Cell as a Standard of Electromotive Force" (*Phil. Mag.*, August, 1885.) Notwithstanding the opposite conclusion by the author, Mr. J. A. Fleming's very careful article shows that it is difficult to get with the Daniell cell a good standard of electromotive force.

‡ Instead of depositing mercurial sulphate, we can produce it by the electrolysis of the sulphate of zinc in the element itself, by causing it to be traversed by a current going from the mercury to the zinc. We are thus sure to obtain pure mercurial sulphate. (Unpublished researches of M. Potier.)

The Gouy element* (1·39 v. on an average) is as remakable for its constancy as the Latimer-Clark; moreover, it only differs from the liquid Latimer-Clark by the substitution of oxide of mercury for the mercurial sulphate. There is in this substitution both an advantage and a drawback; the advantage is that the variation of the electromotive force with the temperature is reduced by almost half (about ·00014); the drawback is that the depolarisation being less efficacious, the polarisation of the Gouy element is much greater, and takes longer to diappear than that of the liquid Latimer-Clark.

Different Gouy elements, prepared from the same materials, do not vary in general more than $\frac{1}{1000}$th of their mean value.

To sum up, the Latimer-Clark element or the Gouy element may be of great service, even in researches where great precision is required; but then it is essential that a thermometer, the reservoir of which is plunged into the liquid of the element, should give the temperature of it. We should also measure, from time to time, the absolute value of the electromotive force of the standard, and frequently compare its value to similar standards, placed in the same conditions as to temperature, in order to make sure that no accident has made its electromotive force vary to any important extent.

One of the principal uses of a standard of electromotive force, the absolute value of which is known, is the rapid and exact measurement of the intensity of a feeble or strong current by the opposition of this standard to the difference of potential developed by the current at the two ends of a resistance suitably chosen, and the absolute value of which is known, thus reversing the operation that served to determine the absolute value of the element. These two operations together constitute the most simple and exact manner of comparing the value of a current obtained by an absolute electro-dynamometer or by a standard ampère to the value of another current of very different intensity.

(*To be continued.*)

AMERICAN NOTES.

By DAS TELEPHON.

THE committee recently appointed by the San Francisco Chamber of Commerce to investigate the feasibility of laying an ocean cable from San Francisco to Australia, has reported in favour of the project, and estimates the cost of a cable from San Francisco to New Zealand, by way of Honolulu and Tutuila, at ten millions of dollars, and it is said Mr. John Mackay, and several other millionaires of San Francisco, are ready to put up the total amount.

It seems that electrical projects and millions of dollars are inevitably connected together. The certificate of incorporation of the "Edison General Electric Company," lately issued by the Secretary of State of New York, required the payment of fifteen thousand dollars to the State Treasurer on the capital stock of twelve millions of dollars. This company has been formed by Thomas A. Edison, and other millionaires, to carry out the recently projected arrangements for consolidating the Edison Electric Light and Manufacturing Companies throughout the United States and Canada.

Mr. Frank M'Gowan has lately returned from South America, after an absence of a year and a half, whither he was sent by Mr. Edison to procure specimens of bamboo for incandescent lighting. His travels carried him through the unbroken forests of South America, where he encountered not only wild beasts, snakes, reptiles, crocodiles, and predatory bands of Indians, but exposed himself to the wasting ravages of low fevers. He forded rivers, waded swamps, penetrated unknown mountain fastnesses, and scaled the lofty Cordilleras. He ascended the Amazon 2,300 miles, and traversed the Continent from ocean to ocean.

Mr. Edison is well pleased with the result of the exploration, and has lost no time in directing experiments with the large and varied stock of fibrous materials brought home by McGowan. Some of the specimens of bamboo have given good results, as the wood naturally splits into very thin strips, and has great strength; and the substance is homogeneous throughout, and when carbonised retains great strength. This discovery, Mr. Edison thinks, is of vast importance.

The substitution by law of electricity for the gallows in New York threatens to liberate a large batch of condemned murderers. Owing to the technical mess into which the gush of sentimental reformers of the mode of capital punishment has got the law, 14 condemned murderers now imprisoned in the Tombs in New York City have a prospect of escaping the death penalty. The law says they must be sentenced to be put to death by electricity, yet there is great probability that in the appeal from the first sentence under this new law the Court of Appeal may decide that the electrical mode of execution is unconstitutional, being "*cruel and unusual;*" the sentence, therefore, could not be executed. If the penalty be changed, the lawyers will contend that the culprit cannot be re-sentenced under a return to the old mode of hanging, and must perforce go free, since the law expressly states that murders committed since January 1st, 1889, must be punished under the electric execution code. If the Higher Court says this way cannot be used, then there is no way in which the death penalty can be carried out, and the culprits must be set at liberty, unless the Governor commute their sentences to imprisonment for life.

By invitation of the directors of several of the street railroads of Baltimore, I went over to Philadelphia last week to witness the operation of the cable cars in that city.

The manner of operating the cars is very simple. One car, (sometimes two cars, are coupled together) is managed by two men, one the grip man, the other the conductor. The grip man is on the front platform, holding in each hand a lever, that in his right connecting with the cable, that in his left operating the break. The car, when going at the speed of six miles an hour, can be stopped in a shorter time than when drawn by horses.

The distance I travelled over was about two miles, with many curves around the corners of the streets, and up several steep grades.

Anent Edison's *later than the last discovery,* "*Life*" publishes the following:—

Cumso: I see that Edison has invented a machine by means of which a person's face can be seen miles away.

Mrs. Cumso: Oh, how nice! You'll get one, George, and then when we go to the theatre you can see a man on the street without leaving your seat.

That the benighted inhabitants of your little island may be able to appreciate "Life" saying, it should be mentioned that in this great unbounded continent "to go out to see a man," means to go and imbibe.

Baltimore, *August 27th.*

NEW PATENTS—1889.

13444. "Improvements in dynamo machines and the application thereof for regulating electric arc lamps, and other purposes." F. REISINGER and W. WENZEL. Dated August 26.

13541. "Improvements in electric wire and pole connectors." C. R. BONNE. (Communicated by Messrs. Mix and Genest, Limited, Berlin.) Dated August 27. (*Complete.*)

13553. "Improvements in electrical signalling apparatus for preventing collisions between trains on railways." E. EDWARDS. (Communicated by T. Perls, Germany.) Dated August 27.

13557. "Improvements in or connected with holders or sockets for incandescent electric lamps." J. Y. JOHNSON. (Communicated by J. W. Collier, United States.) Dated August 27. (*Complete.*)

13580. "An electric body belt." G. H. REDFERN. Dated August 28.

13636. "Improvements in the manufacture of indigo by the application of electricity." F. HUGHES. (Communicated by Æ. J. McDonald, East Indies.) Dated August 29. (*Complete.*)

13640. "Improvements in electric switches." W. THOMPSON Dated August 29.

13658. "Improvements in automatic transmitters for telegraphic purposes." H. LUBLINER. Dated August 29.

13675. "Improvements in the arrangements and apparatus for electrically lighting railway trains." W. E. LANGDON. Dated August 30.

13778. "Improvements in electric bells, and in apparatus for use in connection therewith." C. H. MARTIN. Dated August 31.

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* Gouy, "On a Standard Battery," *Journal de Physique.* 2nd Series, Vol. VI., page 532.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1888.

11968. "Improvements in or connected with electric rail or tramway systems." M. H. SMITH. Dated August 18. 8d. The inventor proposes to use a main supply cable, from which the current is led to insulated motor bar sections through suitable switches, for operating which a separate and distinct sectional conductor is employed. The return current from the car passes by means of the rails or by a second conductor, as may be preferable. 7 claims.

12290. "Improvements in galvanic batteries." A. SCHANSCHIEFF. Dated August 25. 8d. Relates to methods of charging the tubes with liquid and emptying them. 3 claims.

13648. "Improvements in circuit making and interrupting devices for electric bells and other purposes." W. SNELGROVE. Dated September 21. 8d. A bell is mounted in any usual manner, and it is struck by a hammer at the end of a lever; the acting stroke is given by an electro-magnet attracting an armature upon the lever, and the hammer is taken away from the bell by its weight or by a spring. The making and interrupting of the electric circuit is controlled by a second lever, which is actuated by the hammer lever, but is moved only when near the termination of the hammer stroke in either direction; the second lever carries or actuates a cam, which moves a spring and causes contact to be made or interrupted. 5 claims.

14149. "Improvements in and connected with dynamo-electric machines and electric motors." B. WILLCOX. (Communicated from abroad by C. S. Bradley, of America.) Dated October 2. 8d. The armature is by preference of the "ring" type and is wound throughout, the coils being preferably looped into a closed circuit in the usual manner, so that connections may be made to the plates of an ordinary commutator. In addition, connections are carried from four points of the armature circuit distant apart 90 degrees to four insulated collecting rings on the shaft, each two diametrically opposite, constituting a pair. Brushes are in contact with the commutator, and from them connection is made with the field magnet, which may have two poles, or a multiplicity of poles alternating regularly in polarity. Separate brushes are in contact with the collecting rings, and each pair can be connected to a separate external circuit. Such a machine is self-exciting, and will generate and deliver into the said two separate external circuits two independent alternating currents, one of which will be one quarter of a phase or wave length behind the other. 9 claims.

16881. "Improvements in multiplex telegraphy." F. J. PATTEN. Dated November 16. 1s, 1d. Relates to multiplex telegraphs, and embodies a new mode of synchronising the electric motors which drive the distributing apparatus at different stations, so as to preserve perfect unison between rotating trailers or other devices adapted to distribute current to local stations successively connected into signalling relation to each other. Also embodies means of utilising the synchronous movement effected by the motors to render the multiplex telegraph reliable, and to enable a large number of messages to be sent by a large number of different operators using their transmitting instruments at the same time. 2 claims.

16881A. "Improvements in synchronising a series of electric motors." F. J. PATTEN. Dated November 16. 8d. Relates to a mode of and apparatus for synchronising electric motors, and especially those which are used for driving the distributing apparatus at different stations for the purposes of and in conection with the system of multiplex telegraphy. 4 claims.

1889.

9589. "Improvements in electric apparatus for indicating the direction and speed of revolution of engine shafts." J. C. RICKETSON. Dated June 11. 8d. Has for its object the construction of devices for indicating at any point distant from the shaft of an engine the direction in which the said shaft is revolving, as well as to indicate the speed of such revolutions, and is, in part, an improvement on the devices set forth in patent No. 16,742, granted December 6th, 1887, and, as in said patent, is especially designed for use in connection with the shaft of a marine engine, though capable of use with any reversible shafting, whether on land or water. 3 claims.

9638. "Improvements in telephonic and phonographic transmitters." E. S. DRAKE. Dated June 11. 6d. Claims:—1. A transmitter, embodying the combination of a diaphragm, with a supporting case or front, provided with separate but connecting inlet and outlet air conduits or passages, so respectively arranged relatively to the diaphragm that the vocalised impulses directed to the diaphragm through the inlet passage will be reflected directly therefrom through the outlet passage, as and for the purposes specified. 2. The combination of diaphragm with door or front provided with air passages, leading obliquely to and from the diaphragm at equal angles thereto, coinciding with the angles of incidence and reflection of the sound waves conducted thereto and therefrom through said passages, as specified.

10295. "Improvements in electric telegraphic apparatus." W. P. THOMPSON. (A communication from abroad by C. G. Burke, of America.) Dated June 25. 8d. Relates to receiving instruments adapted to the transmitting instruments at present in use, and also embraces new methods and means for transmission, and is applicable to the several forms of recording signals whether by the movements of a ray of light as produced by a mirror galvanometer, the tracings on a paper strip as by the siphon recorder, or by the manifestations of sound where a sounder is operated in a local circuit through the interposition of a suitable relay in the main circuit. 8 claims.

CORRESPONDENCE.

A Retraction Required.

In looking over a file of the ELECTRICAL REVIEW to-day, I came across a communication in the issue of June 21st, 1889, entitled "The Mammoth Combination," signed "Suum Cuique," in the body of which I find this remarkable statement: "It is also a rather interesting bit of history that even in America, where they get ahead so fast, Sprague did nothing in electric traction until after his brother had ridden upon a car Holroyd Smith was exhibiting in Paris, and had forwarded him a description of the Blackpool line."

There is but one way to characterise this statement. It is a falsehood, without the shadow of substance to uphold it, and for the following very simple reasons:

1. At the time of the Paris Exhibition I was at sea on duty on a Government ship, and until a long time afterwards did not even know of the existence of Mr. Holroyd Smith or his Blackpool line, or that he had any car at the Exhibition.

2. I have, and had, but one brother, he much younger than myself. He has never been in Europe, and does not even now know that there is such an individual as Holroyd Smith, or such a railway experiment as the Blackpool line.

3. No detail of my work, so far as I know, has any resemblance to any prior description of any part of Mr. Smith's work.

I am at a loss to conceive what fertile imagination produced a tale with such an utter lack of substance, and am somewhat amazed at the hardihood which dictated its publication. Criticisms of my method of working, of my want of knowledge, of my lack of attainments, scientific, commercial, or otherwise are allowable, and I suppose inseparable from a business which has to deal with hard practical facts. I have no wish to deny to anyone who has the time and inclination, the pleasure he may derive from this sort of amusement, because I am very conscious of my own defects, and can even add material for an effective attack. But there is a limit to this sort of thing, and "Suum Cuique" has gone far beyond it. With the general tenor of the article I do not wish to concern myself, but I shall look for the motive which actuated it in the identity of the writer, and with the quoted extract I purpose to concern myself very particularly. It is not an uncommon practice with historians of a certain class, when wishing to parade their own accomplishments and to covertly attack the work of others, to seek the semi-protection of an *alias*.

But this *alias* will not protect. I think I am justified in expressing my belief that "Suum Cuique" is no other than Mr. Holroyd Smith himself; or, at least, that he is responsible for the quoted statement, because I was recently informed that when in the United States he made a similar statement to a well-known electrical man.

But whoever "Suum Cuique" is, whether Mr. Smith or some other, he must come out from the shelter of this covert and show his authority for his statement or make a retraction of it. There is no room for argument or quibble. The statement is unvarnished; I have shown its falsity. Its retraction must be prompt, complete, and unequivocal.

Frank J. Sprague.

London, *September 9th*, 1889.